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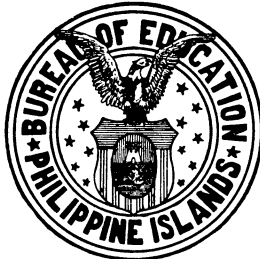
no. 31

UNIV. OF MICHIGAN

BULLETIN No. 31 (REVISED)—~~1913~~ <sup>AUG 6 1914</sup>  
BUREAU OF EDUCATION

# SCHOOL AND HOME GARDENING

FOR USE IN  
PRIMARY GRADES



MANILA  
BUREAU OF PRINTING  
1913

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## BUREAU OF EDUCATION PUBLICATIONS.

[Abbreviated list.]

### ANNUAL REPORTS:

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- Eleventh Annual Report of the Director of Education. 1911.
- Twelfth Annual Report of the Director of Education. 1912.
- Thirteenth Annual Report of the Director of Education. 1913.

### BULLETINS:

- 1 to 30. Various subjects relating to the early activities of the Bureau. Editions for the most part exhausted and material obsolete.
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- 33. Philippine Hats. 1910. (Edition exhausted.)
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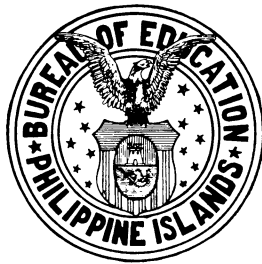


General vegetable exhibit at the 1913 agricultural exhibit of the Bureau of Education.

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## FOREWORD.

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The increased emphasis which has been placed upon the teaching of all lines of industrial work and the development of school and home gardening in the public schools have made it necessary to revise Bulletin No. 31, School and Home Gardening. The original issue of this bulletin was an essential first step in the general introduction of instruction in agriculture. It outlined gardening as prescribed for all elementary schools in the Philippine Islands.

The following part of the foreword is repeated:

The food supply of the people must be bettered through the improvement and wider distribution of fruits and vegetables; a pride in home surroundings which will not tolerate ill-kept houses and premises must be fostered; children must be led to recognize the dignity of manual labor; the number of the intelligent property-owning middle class of farmers must be increased. Directly or indirectly it is believed that all of these ends will be promoted through the agency of the school garden. The place assigned this work as a required and accredited subject of instruction in the public schools is indicated in the published course of study.

This bulletin sets a standard for school and home gardening in the primary course. It has been prepared under the direction of Mr. C. H. Magee, Assistant Director of Education. The work of placing the manuscript in its final form was done by a committee composed of Messrs. Glenn W. Caulkins, North H. Foreman, J. A. Cocannouer, and Adam C. Derkum. Much of the material was submitted by the following collaborators: Mr. North H. Foreman, inspector of school and garden sites; Mr. R. E. Spencer, division industrial supervisor, Albay; Mr. R. B. Robinson, industrial supervisor, General Office; Mr. K. O. Moe, superintendent of the Central Luzon Agricultural School; Mr. W. A. V. Wiren, formerly principal of the Batac Farm School; Mr. J. A. Cocannouer, principal of the Indang Farm School;

Mr. W. K. Bachelder, instructor in gardening, Philippine Normal School; Mr. John Carbonell, formerly division industrial supervisor, Union; Mr. Camilo Osias and Mr. Antonio Nera, supervising teachers, Union; Mr. W. F. Montavon, division superintendent of Tayabas; and Mr. S. P. Stewart, division superintendent of Occidental Negros.

FRANK L. CRONE,  
*Director of Education.*

MANILA, *October 1, 1913.*

# SCHOOL AND HOME GARDENING.

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## Chapter I.—GENERAL PREPARATIONS.

### INTRODUCTORY.

The objects of teaching gardening in the public schools are manifold. The primary aim, however, and the one with which the public schools of the Philippine Islands are most deeply concerned, is to bring about a higher standard of living by providing:

1. A more abundant food supply.
2. A greater variety of food.
3. Food of better quality.

This aim is accomplished by emphasizing in garden work four distinct features:

1. Instruction in the fundamental principles of gardening and plant life.
2. The demonstration of these principles in the school garden.
3. Their application at the pupil's home, involving productive work in the home garden.
4. The giving of definite credit for supervised work both at school and at home, which will have its proper weight in considering the promotion of the pupil.

The value of the instruction received is determined by the extent to which it is applied at the pupil's home and by the degree in which the standard of living has been raised thereby.

### THE PLACE OF GARDENING IN AGRICULTURE.

Gardening is one of the most intensive branches of agriculture. The boy engaged in gardening should master principles which may be of great value to him when dealing with the broader phases of agricultural work. School gardening is really a stepping-stone to the growing of products on an extensive scale. The principles which apply to the

working of the soil in a small garden plot quite as fully apply to the rice field, the corn land, and the orchard. Different methods of working may be necessary, but the same general result is sought—that of securing the greatest possible production with the least possible cost.

#### SCOPE OF THE WORK IN PRIMARY GRADES.

A sharp distinction should be made between gardening in the primary and intermediate grades. Gardening in the primary grades should confine itself to the study of how to grow successfully the most common vegetables. No experi-



School garden, Bulacan, Bulacan, March, 1913.

menting with new plants or fertilizers should be undertaken. Plants which are difficult to grow should be left for pupils in the higher grades. It is quite important that pupils beginning garden work should meet with as little discouragement as possible; consequently the vegetables chosen should be only those which are most likely to succeed. On this account, native vegetables are to be preferred to those recently introduced.

In the primary grades such field crops as corn, yams, gabi, and camotes may be raised, but field crops generally will preferably be grown in the intermediate grades.

Through the home gardens, food for the family will be provided. The saving of seed, the keeping of records, the establishment of a nursery for the propagation and distribution of fruit, shade, and ornamental trees and shrubs, and instruction in the fundamental principles of gardening should be taken up and covered as fully as possible in the primary grades.

#### THE GARDEN SITE.

It is the policy of the Bureau of Education to acquire standard sites for all schools. One of the requirements of a standard-school site is that it shall contain adequate and suitable land for the school garden.

The requisites of a satisfactory garden site follow:

1. It must be large enough to provide (a) one standard plot for each gardening pupil, (b) nursery, (c) seed house, and, if necessary, (d) a well.

2. It must be near a water supply or should not be so high as to make the sinking of a well difficult. An adequate supply of water is necessary.

3. The land should have sufficient slope to drain off during heavy rains. The surface of the garden should not contain depressions in which water will collect.

4. The soil should be fertile and suitable for growing vegetables.

5. The site should not be shaded by trees or buildings.

Whenever possible, the school and home gardens should be located where they will be seen by the people. It is necessary that the location of the gardens with reference to the other school activities and to the school buildings be considered.

#### BORROWED GARDEN SITES.

In some localities it is still necessary to borrow or rent land for garden sites. In such cases a contract or agreement should be made with the owner to insure the use of the land for several years and to provide against any complications which might arise. It usually requires one year's cultivation to put the land in proper condition for gardening. If a new site is used each year the results secured will not compare favorably with the time and labor expended.

## Chapter II.—FENCES.

### NEED OF FENCES.

The necessity for fencing gardens is obvious. In most localities domestic animals are permitted to run at large, so that one of the requirements of a garden is that it shall be protected against them. Where the garden is on a permanent school site it should be inclosed with a standard permanent fence. Plans and specifications of permanent fences have been issued by the General Office; for further information relative to permanent fences reference is made to *The Philippine Craftsman*, Vol. II. No. 1.

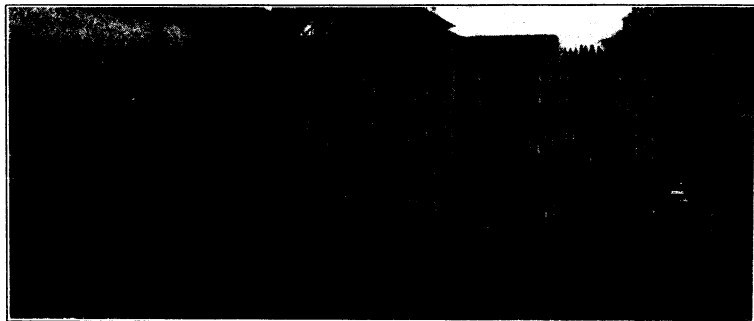
### TEMPORARY FENCES.

The plan of the Bureau is eventually to inclose all school sites with permanent fences; yet, garden fences will, for some time probably, be of a temporary character. Temporary fences should be neatly constructed by the pupils under the supervision of a teacher. In places where bamboo is plentiful it may either be furnished free by the pupils or purchased with school funds.

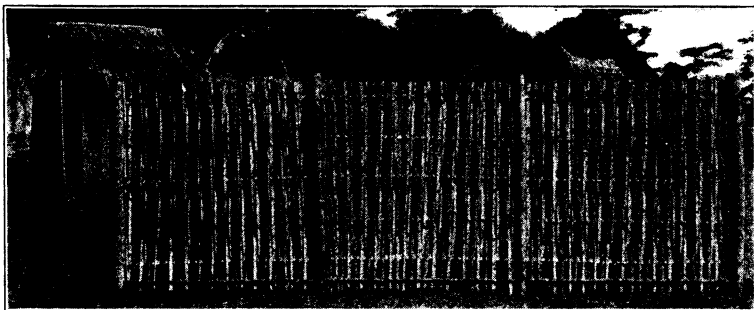
All of the boys in the garden classes should be employed in constructing the garden fence and care should be taken that each boy does his share of the work. It is a good plan to divide the boys into groups and give each group a section of the fence to complete. The teacher should personally supervise the work of all of these groups. Good work must be insisted upon. The work should be carefully planned in advance and sufficient material should be on hand before the fence is begun.

The pupil's home garden must be fenced before it is planted. He should secure his material and be given a certain number of days in which to complete the work. The plan of the fence should be furnished, or at least approved, by the teacher before the work is begun. Upon the completion of the fence the pupil should be given a rating on

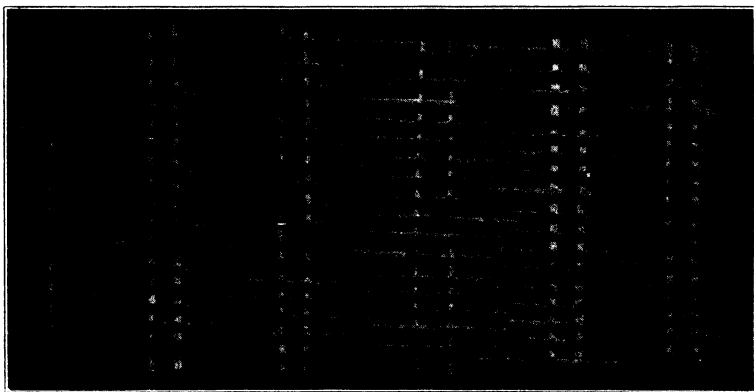




A good bamboo fence constructed by teachers at the 1912 Vacation Assembly, Manila.



Type of bamboo fence and bamboo closet—1912 Vacation Assembly.



Another type of bamboo fence.

it, consideration being given to its construction, neatness, serviceability, and the length of time consumed in its construction.

Approved types of temporary fences have been constructed by primary pupils and have been found satisfactory if built according to directions.

In many parts of the Islands shrub fences have proved to be very satisfactory and are thought by many to be valuable temporary fences for fields where it is not essential that chickens and small animals be kept out. The seeds or cuttings of shrubs are planted in line where the fence is wanted, so close together that main trunks may serve as pickets. When these grow up the principal part of the fence may be said to be almost permanent. Long strips of bamboo are tied horizontally to this row of shrubs. These bamboo strips will have to be replaced often, but the main part of the fence will live for years. Such a fence has the appearance of a tall hedge; it is less suitable than other temporary fences for a vegetable garden because of the failure to keep out small animals. Shrubs appropriate for this purpose are *tagumbao* and *madre de cacao*.

A temporary fence should be not less than 1 meter in height. It is understood, of course, that temporary fences are provisional and that they will be replaced with permanent fences as soon as funds can be secured. It is, therefore, not advisable to spend very much money on their construction.

### Chapter III.—PREPARING THE GARDEN.

#### PLANNING THE GARDEN.

As soon as the garden site is selected, the teacher is ready to draw up a plan of the entire garden. On this plan should be given accurate dimensions of the site and the location of each plot. A standard-size plot as here considered is 1 meter wide and 4 meters long. The number of plots in the garden should equal the number of pupils in the garden class. A school with a garden class of 24 pupils should

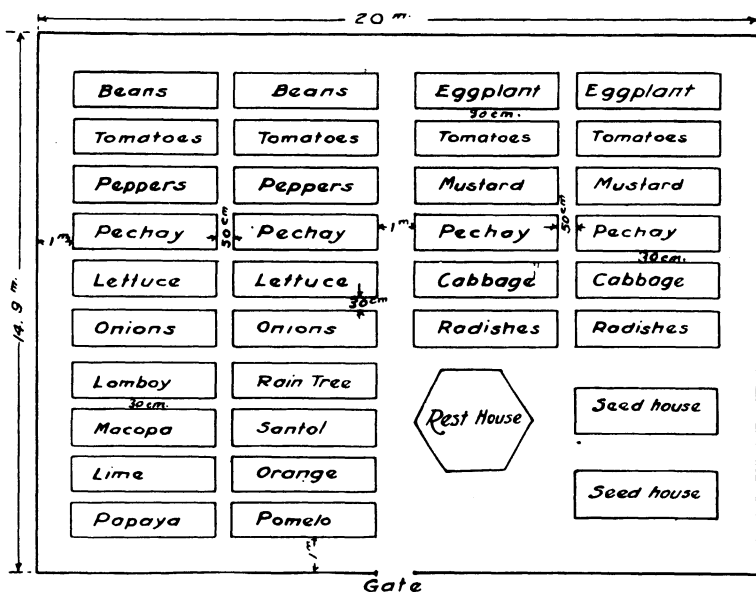


A class in gardening, Albay, Albay.

plan a garden of 24 plots only, and not a garden of 40 or 50 plots. The plots should be separated by paths from 30 to 50 centimeters wide. All paths should be of uniform width in order that the garden may have a symmetrical appearance. The plan made by the teacher should also contain the assignment of vegetables for each plot and the assignment of plots to pupils. The plan should be posted on the school bulletin board so that the pupils in the garden class will know the exact location of their plots.

It is essential that the garden be planned for individual

plots, because in individual ownership lies the key to successful school-garden work. A communal garden does not develop the idea of responsibility, and each pupil has a tendency not to care for the plants which another has shared in producing, with the result that responsibility is shirked and there is a lack of interest with a consequent lack of industry. The idea of ownership and a respect for the property rights of others come with the possession of an individual garden. The suggestions regarding the proper methods of planning the garden should be fully



Plan of a primary central school garden. The plots are standard size, 1 by 4 meters.

explained to the class. In every case the garden should be so planned as to conform exactly with the requirements as herein set forth.

#### SELECTING THE GARDEN CLASS.

The success of school and home gardening depends in large measure upon the selection of the pupils for this work. Garden teachers should make the class conform in size to the definite requirements for primary schools. These requirements are that garden classes in barrio schools shall

contain from 8 to 16 pupils, and that garden classes in central schools shall contain from 12 to 24 pupils for each teacher assigned to supervise garden work. This limitation of the size of the classes is necessary in order that the full requirements may be met by pupils doing gardening as an industrial requirement. As soon as the size of the class is determined, the teacher should assemble all the boys of the school who are eligible for this industrial work and select the boys for the garden class. Boys should be chosen who are able to meet the full requirements, who are strong enough to do the work, and who wish to take this work. The teacher should give preference to pupils who are able to have a standard-size home garden near the central part of the town so that their gardens may be easily inspected. A home garden of not less than four standard plots is required of each pupil taking gardening as an industrial subject. It is not expected that pupils will be selected for garden work who live in the country and whose home work is not near enough to be readily inspected. Out-of-town pupils may be selected, provided that vacant lots or other land near the schools are cultivated as home gardens. To recapitulate, the teacher should observe the following points in selecting a garden class:

1. Select pupils when the other industrial assignments are being made at the opening of the school year.
2. Choose pupils from the second, third, and fourth academic grades for this work; consider all male pupils who are enrolled in these grades and who are of sufficient size to be eligible for the garden class.
3. Give preference to the boys who wish to take garden work and who are able to meet the requirements.
4. Select boys who can have their home gardens within a few minutes' walk of the school.

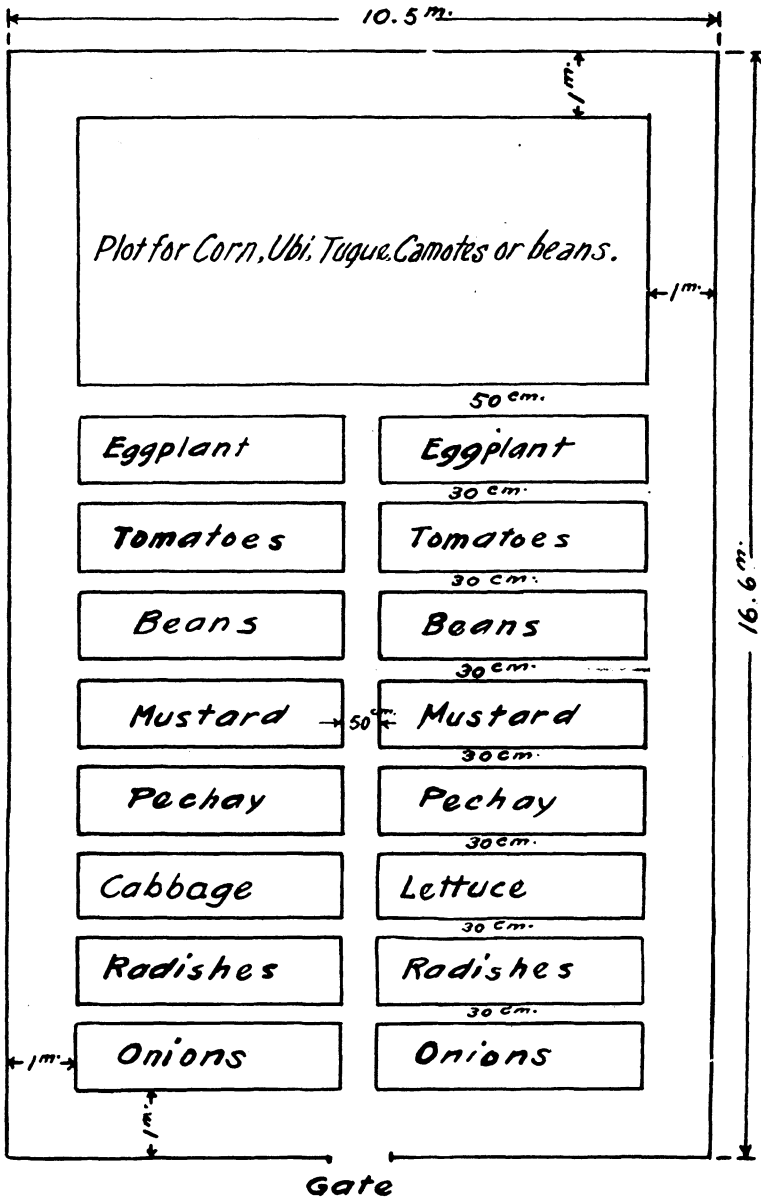
The requirements of this line of industrial work are such that certain home conditions are essential and pupils that cannot meet the home conditions should not be permitted to take the work. It is an excellent plan for the boys to cultivate the vacant lots in the town; in this way boys who board in the town may secure land for the home gardens.

## ASSIGNMENT OF PLOTS.

When the garden class has been selected, the teacher should take the boys into the garden, and lay out the plots according to his previously arranged plan. At each corner of a plot a stick should be driven into the ground until only 10 centimeters extend above ground. This will enable the boy to locate the corners easily. Each boy of the garden class must be assigned a standard plot and be told what vegetables to plant there. As soon as he receives this assignment of his plot he becomes individually responsible for that particular piece of ground. He should begin at once to prepare the soil and to get the plot ready for planting. The class must understand at the beginning that the paths are to walk on, that they should be kept free of weeds and grass, and that the pupil whose plot adjoins a path is responsible for the care of the path. In case plots lie at the edge of the garden the path between the garden and the fence should be taken care of by the boy who owns the plot. Care must be taken that the alignment of the plots is preserved.

## PLANTING VEGETABLES.

The general arrangement for planting the garden should be worked out in advance in order that the vegetables may be so grouped as to make a pleasing appearance. It is desirable that the selection of the vegetables for the garden be complete and that preference be given to native vegetables. When the assignment of plots is made, the boy learns what vegetable he is to plant. He should be taught to cultivate that plant successfully, although it may not be a vegetable he prefers. The value of assigning one vegetable to a plot in the school garden lies in the fact that it encourages home gardening. A boy will not be satisfied with the plant grown in his school garden, and he will therefore cultivate in his home garden other plants in which he is interested. The extent of his home garden will in this manner be influenced by the natural desires of the boy. If he is satisfied with five varieties of vegetables, he will do no more than meet the exact



Plan of barrio school garden. The small plots are standard size, 1 by 4 meters.

requirements; but if he desires other plants he must extend his garden by making an additional plot for every other vegetable he wishes to cultivate.

#### PLANNING THE HOME GARDEN.

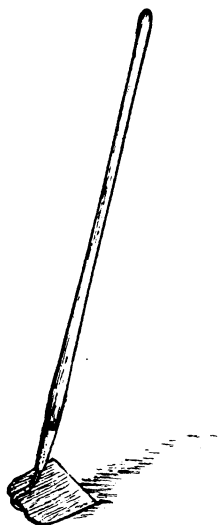
The home garden is a piece of land located either at the home of the pupil or on a site other than the school land. Each garden must be separately fenced and planted to vegetables grown under the direct supervision of the teacher. A pupil who grows a few plants scattered over the home yard is not meeting home-garden requirements and cannot be given a grade for such work.

At the same time that the teacher is planning his school garden he should visit the home of each boy who has been selected for the garden class. This visit is necessary in order that the teacher may become acquainted with the home surroundings of the boy and be able to assist him in selecting a place for his garden. The home garden must be properly located and must be large enough to meet the garden requirements. The selection of the home-garden site must not be left to the pupil, as both the dimensions and the location must have the approval of the teacher. The teacher upon his inspection trips can aid the boys in securing land and advise them as to suitable surroundings. The teacher will also indicate the proper style of fence to be built and will assist the pupil in drawing up a definite plan indicating the exact size and the location of the plots. The vegetables to be planted may be decided upon at the same time.

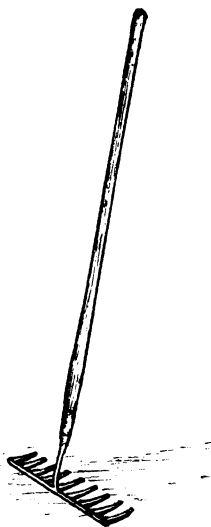
#### NEED OF TOOLS.

While modern garden tools are a valuable aid to garden work, successful gardens are often made with the most ordinary tools. It is believed that each school should be equipped with the list of tools given in this bulletin, but the lack of these tools need not prevent any school from doing successful garden work. In selecting tools care should be taken to secure only those which are essential. Every garden teacher should pride himself upon the fact

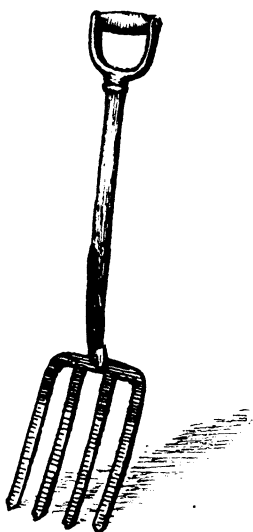




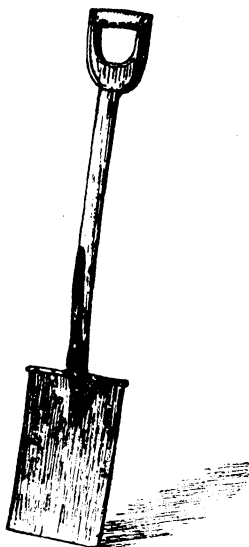
Light hoe.



Rake.



Spading fork.



Spade.

that many of his tools are common in the locality, and that such other tools as he may have for the pupils are an advantage but not a necessity.

#### LOCAL TOOLS.

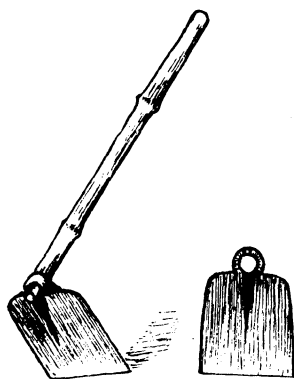
No school in the Philippines need be entirely without garden tools. Small crowbars are common in every agricultural community in the Philippines and are suitable for turning the soil in small tracts; they are in sizes suited to the age of the boy. If the area of the land to be turned is just sufficient to meet the garden requirements it can be prepared in this manner almost as readily as with a more modern implement. A short stick with a sharp iron tip is often used for loosening the soil when only a small tract of land is to be prepared. The heavy hoe and the working bolo are frequently employed for the same purpose. Many of the best school gardens are now made, and for some time will continue to be made, by pupils who use only local tools.

#### SOME TOOLS AND THEIR USES.

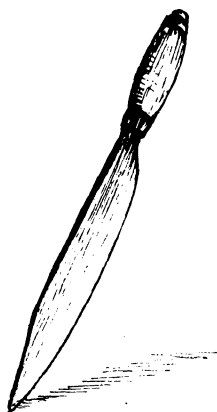
The names and uses of some of the more common tools are here given:

- |                  |             |
|------------------|-------------|
| 1. Spading fork. | 5. Crowbar. |
| 2. Rake.         | 6. Bolo.    |
| 3. Shovel.       | 7. Hoe.     |
| 4. Spade.        | 8. Trowel.  |

A *spading fork* is used in loosening the ground in preparing the plot before planting. It is serviceable only in soil which is loose and mellow. A *rake* is a garden tool for clearing the ground and in making the top soil fine. Another use is to smooth the top surface of the soil. It should not be used for digging or breaking hard clods. To inspect a set of garden tools and to find that the teeth of the rake are bent or missing leaves the impression that proper instructions regarding the use of tools have not been given as a regular part of the garden work. The *shovel* is a tool for digging loose material, but not for prying. It is also very useful in leveling by removing the soil from one part of the garden to another. The main use of a *spade* in the garden is for digging hard soil. It can be used also



Heavy hoe.



Bolo.



Shovel.



Garden trowel.

for removing trash or soil. A *crowbar* is a short iron bar of different lengths which is found in all agricultural communities of the Philippines. This bar may be secured in any town. It is very useful in loosening the lower soil. It is often used for preparing plots in the garden and in setting the posts and stakes of the fence. An iron-tipped stick is used for the same purpose as the crowbar. A *bolo* is a large heavy knife which is common in every part of the Philippines. The bolo may be used for digging and loosening the soil. A sharp bolo will be found of service in constructing bamboo fences. *Heavy hoes* are common in the Philippines, and are used for digging and tilling the soil. Instructions as to the use of *light hoes* should be given, as they are easily broken. The fact that the common use of the hoe in the Philippines is for turning up heavy and hard soil makes it advisable for the teacher to supervise properly the work of the pupil using a light hoe. It is believed that but few light hoes should be included in garden equipments. A *trowel* is a light hand tool for loosening the soil around growing plants.

#### SETS OF GARDEN TOOLS.

In order that a teacher may know what equipment is desirable, three approved lists are given below:

##### 1. For a class of 24 garden pupils.

|                        |               |
|------------------------|---------------|
| 3 grub hoes.           | 6 rakes.      |
| 4 weeding hoes.        | 2 crowbars.   |
| 8 heavy hoes.          | 6 bolos.      |
| 6 garden hoes, 6-inch. | 4 sprinklers. |
| 6 spading forks.       | 4 buckets.    |
| 1 shovel.              | 6 trowels.    |
| 4 spades.              | 1 tape.       |

##### 2. For a garden class of 12 pupils.

|                        |               |
|------------------------|---------------|
| 2 grub hoes.           | 3 rakes.      |
| 2 weeding hoes.        | 2 sprinklers. |
| 6 heavy hoes.          | 1 tape.       |
| 3 garden hoes, 6-inch. | 3 bolos.      |
| 3 spading forks.       | 3 trowels.    |
| 1 shovel.              | 1 crowbar.    |
| 2 spades.              | 2 buckets.    |

3. *For an individual home garden.*

|                       |         |
|-----------------------|---------|
| 1 spading fork.       | 1 rake. |
| 1 garden hoe, 6-inch. | 1 bolo. |
| 1 heavy hoe.          |         |

The above lists of tools are given as a guide to teachers and pupils in ordering equipment.

PREPARATION OF THE SOIL.

The school garden should be prepared by the garden pupils. The garden site is first cleared and plowed if



Well-prepared garden, Nagcarlan, Laguna, March, 1913.

possible; plowing serves to make it easier to work the individual plots. As soon as the whole garden has been plowed and leveled immediate steps should be taken to lay off and make the plots. One essential fact to impress upon the boys is that the soil must be worked to a depth of 30 centimeters. Bamboo sticks which have 30 centimeters marked on them should be given the boys for testing their plots. As soon as the garden plots are finished each boy should prepare his home garden, using his school plot as a model. After the plots have been prepared to the proper

depth they should be worked fine and all clods broken. When completed, all plots in the garden should be the same size and height. All paths should be level and should be 6 centimeters lower than the top of the plots. This will insure proper drainage and will give the garden a good appearance. Plots should not be higher than 6 centimeters, as otherwise too much ground is exposed during the dry months.

#### FERTILIZATION OF THE SOIL.

The fertilizer should be worked into the soil as soon as the plots have been dug up. In fertilizing individual plots the teacher should specify the quantity of fertilizer to be used. It is a well-known fact that much larger yields of most varieties of vegetables can be secured by the use of a large quantity of fertilizer. A pupil should be taught to use the fertilizer which can be found near his home. This can best be secured from the places where carabaos or horses have been stabled. A fertilizer known as guano, which is a manure from bats and birds, usually found in caves and the attics of churches and other old buildings, is common in many places and has given excellent results. In using guano the pupils should be instructed to mix other manure with it. New manure is not to be taken, as it is apt to become heated and to retard the growth of the plants. In stating what fertilizer is to be used the instructor should make it clear to the boy that each plot should receive the amount designated. Certain vegetables, like carrots, must not have highly fertilized plots. In inspecting the work in the school and in the home gardens the teacher must assure himself that the pupil has fertilized his plots according to the needs of the vegetable to be grown.

#### MANURE AS A FERTILIZER.

In the primary schools it is not expected that the use of commercial fertilizers will be encouraged. By commercial fertilizers is meant the manufactured kinds which are sold in the market. While these fertilizers are excellent for specific purposes they do not excel local manures. It is preferable that school pupils become acquainted with the

use of the manures which are common in the locality although they may be at present little used. The teacher should emphasize the fact that any vegetable matter which is turned under the soil will in time serve as a plant food. It should not be burned, as is the common practice. Fertilizers should be worked into the soil and not placed on top; consequently surface manuring should not be practiced in primary gardens.

#### Chapter IV.—PLANTING THE GARDEN.



After the boy has finished constructing or repairing fences and preparing and fertilizing the plots, he is ready to do the more interesting part of his garden work. It is only by thinking of the time when he shall plant his seed and see his young plants growing that he willingly performs the hard work of preparation and fertilization. When the proper planting season arrives and the boy reports that fences are constructed, that the soil has been prepared 30 centimeters deep, that the plots and paths are of proper size, and that the soil has been fertilized, the teacher should inspect the home garden and give the boy permission to plant according to the plans for planting. In no case shall a pupil be permitted to plant until the teacher is sure that everything is ready.

##### SEEDS NEEDED.

The question of securing seeds should be taken up many months in advance in order that they will be available when needed. Whether or not the class will have seeds at the proper time for planting depends largely upon the foresight of the teacher. Seeds may be classified into two distinct groups:

(a) Seeds of vegetables which thrive best in the wet season.

(b) Seeds of vegetables which thrive best in the dry season.

Each of these groups will include seeds of native plants and seeds which must be purchased or secured from outside sources. Local seeds must be secured several months in advance, since there is at present no place in the Philippine Islands where they may be purchased. Only at certain times in the year is it possible to secure for planting such vegetables as gabi, ginger, arrowroot, tugue, ubi, cassava, and similar plants which are propagated from roots or root cuttings.



Plants propagated from seed usually fruit at the beginning of the dry season and it is difficult to secure seeds at other seasons of the year. Such vegetables as radish, lettuce, pechay, mustard, beans, tomato, eggplant, etc., belong to this group.

#### HOW TO SECURE SEEDS.

The teacher should learn how to secure all seeds needed. Seeds for the school and home gardens may be obtained from five different sources, which are here named in the order of their relative importance: (a) Seeds saved by pupils; (b) seeds secured from neighboring farmers; (c) seeds purchased by the school, municipality, and individual pupils; (d) seeds received from the regular annual seed distribution of the Bureau of Education; and (e) seeds secured from the Bureau of Agriculture.

#### SEEDS SAVED LOCALLY.

The school should be as independent as possible of outside help in gardening; the teacher should, therefore, make arrangements for saving the seeds needed. The fact that when seeds are brought from a distance many of them lose their germinating power and are worthless, makes this plan advisable. Experiments have demonstrated that better results can be obtained after the imported vegetables have become acclimated and when care has been taken in selecting the best plants for seed. Each gardening pupil should be taught to select his seed. Plants chosen for seed purposes should be watched closely, and only the best and strongest of them retained for this purpose. When the school year closes the teacher should have a considerable collection of seeds of different varieties of local and imported vegetables. The type of plant which suits the soil and climatic conditions of the locality is desired. Never save seeds from fruits which have blemishes or which show signs of decay before reaching maturity. Seeds from weak or sickly plants must not be saved. Many excellent plants have degenerated in the Philippines because the best plants and fruits have been used for food while seeds from the smaller and less desirable ones were planted for the next

crop. The bad effects of this practice may be seen throughout the Philippines. Just what can be accomplished in the saving of local seeds and in the development of an acclimated plant through the observation of the simple rules pertaining to seed selection is yet to be demonstrated in the Philippines. Local farmers need a source of seed supply, since the only place where seeds of native vegetables can be secured is from the farmers of the community. It is believed that the farmer should come to the school for seeds. With this object in view, the very best locally grown seeds should be secured and plants should be grown for seed purposes in both the school and home gardens. When a plant is secured which surpasses in quality other plants of the same species it should be carefully preserved and its production extended. A teacher should not shirk this responsibility for the home and school gardens by stating that he has no seeds to plant, when he is surrounded by farmers who make their living from agricultural activities.

#### THE PURCHASE OF SEEDS.

Seeds may be purchased in Manila at certain seasons of the year. The local storekeeper will usually keep on hand such seeds as mustard, pechay, radish, mongo, and possibly a few others if requested to do so. Imported seeds of lettuce, turnips, tomatoes, eggplants, and similar garden vegetables may be secured from at least one Manila firm. It is not expected that imported seeds will remain fertile long on account of rapid deterioration either while en route or while in stock in the Philippines.

#### ANNUAL SEED DISTRIBUTION OF THE BUREAU OF EDUCATION.

The Bureau of Education has annually for several years distributed a small quantity of vegetable seeds. It is not expected that any school will receive from this source enough seeds to supply school and home gardens. The distribution is made only as an aid to gardening and as a means of furnishing new stock each year in order that certain varieties will not deteriorate.

## SEED DISTRIBUTION OF THE BUREAU OF AGRICULTURE.

The Bureau of Agriculture has, since 1911, filled pupils' requests for vegetable seeds. Upon request a package containing seeds of some of the more common and desirable vegetables will be sent. It is believed, however, that neither the pupil nor teacher should depend too much upon this source of seed supply. Requests should be made direct to the Director of Agriculture, Manila, and not through the Director of Education.

No matter what garden seeds are secured, the following principles must apply:

(a) The teacher must make early arrangements in order that he may have seeds at the proper time for planting.

(b) Seeds received from outside sources deteriorate rapidly.

## DISTRIBUTION OF SEEDS TO PUPILS.

Home gardening is a part of the gardening pupils' required school work and the teacher is held responsible for the plants grown in these gardens. In arranging for seeds the teacher should take into consideration the needs of all home gardens. Unless this is done it will be found that often home gardens are a failure because the pupils do not have seeds or plants. Care should be exercised that certain seeds are properly distributed, but a wide distribution of all seeds to pupils is undesirable. Some plants must be grown in seed boxes at the school and the young plants distributed. Large seeds such as corn, radishes, and beans need not be first planted in seed boxes and later replanted. If the pupil is a beginner in gardening, the teacher should be present to see that the planting is properly done. If the boy wishes to plant 100 radishes he should be given 100 good fertile seeds. Small undersized seeds may be destroyed, as they usually do not produce strong plants. Seeds must be planted as soon as received, since many varieties remain fertile only a short time even though preserved in the best possible manner.

To enable teachers to arrange a proper rotation of

vegetables and to ascertain approximately the amount of seeds needed to plant a given area the following table has been adapted from the one distributed by a prominent seed house in the United States.

*A suggestive table giving the amount of seed needed for various plantings and length of time it takes various plants to grow large enough to be used for food.*

| Name of vegetable.      | Seeds needed to plant<br>8 standard 1 by 4<br>meter plots. | Ready for use from seed in<br>about— |
|-------------------------|------------------------------------------------------------|--------------------------------------|
| Ampalaya                | $\frac{1}{2}$ liter                                        | 40 to 60 days.                       |
| Arrowroot               |                                                            | 90 days.                             |
| Beet                    | 100 grams                                                  | 130 to 150 days.                     |
| Beans (sitao)           | 1 liter                                                    | 60 to 80 days.                       |
| Beans (patani)          | 1 liter                                                    | 60 to 80 days.                       |
| Beans (batao)           | 1 liter                                                    | 60 to 80 days.                       |
| Beans (imp. bush)       | 2 liters                                                   | 50 to 75 days.                       |
| Carrot                  | 50 grams                                                   | 100 to 130 days.                     |
| Cabbage                 | 20 grams                                                   | 95 to 120 days.                      |
| Cucumber                | 50 grams                                                   | 140 to 160 days.                     |
| Cassava                 |                                                            | 6 to 8 months.                       |
| Cadlos                  | $\frac{1}{2}$ liter                                        | 6 to 8 months.                       |
| Cowpea                  | $\frac{1}{2}$ liter                                        | 60 to 80 days.                       |
| Eggplant                | 25 grams                                                   | 140 to 160 days.                     |
| Endive                  | 50 grams                                                   | 50 to 75 days.                       |
| Gabi                    |                                                            | 6 to 9 months.                       |
| Ginger                  |                                                            | 90 to 130 days.                      |
| Garlic                  | 2 kilos                                                    | 60 to 90 days.                       |
| Lettuce                 | 50 grams                                                   | 65 to 100 days.                      |
| Mongo                   | $\frac{1}{2}$ liter                                        | 60 to 80 days.                       |
| Melon                   | 50 grams                                                   | 120 to 140 days.                     |
| Mustard                 | 75 grams                                                   | 65 to 100 days.                      |
| Onion (seeds)           | 50 grams                                                   | 135 to 160 days.                     |
| Okra                    | 100 grams                                                  | 90 to 120 days.                      |
| Papaya                  |                                                            | 10 to 14 months.                     |
| Peanut                  | 2 liters                                                   | 90 to 120 days.                      |
| Parsnip                 | 20 grams                                                   | 120 to 150 days.                     |
| Pepper                  | 20 grams                                                   | 120 to 150 days.                     |
| Pechay                  | 75 grams                                                   | 65 to 100 days.                      |
| Parsley                 | 25 grams                                                   | 90 to 110 days.                      |
| Peas                    | $1\frac{1}{2}$ liters                                      | 50 to 80 days.                       |
| Patola                  |                                                            | 60 to 90 days.                       |
| Radish                  | 75 grams                                                   | 40 to 60 days.                       |
| Sweet potato (camote)   |                                                            | 80 to 90 days.                       |
| Sincamas                | $\frac{1}{2}$ liter                                        | 80 to 90 days.                       |
| Squash                  |                                                            | 90 to 125 days.                      |
| Tugue                   |                                                            | 8 to 11 months.                      |
| Turnip                  | 30 grams                                                   | 60 to 75 days.                       |
| Tomato                  | 10 grams                                                   | 100 to 120 days.                     |
| Ubi                     |                                                            | 11 to 14 months.                     |
| Winged pea (calamismis) | $\frac{1}{2}$ liter                                        | 60 to 80 days.                       |

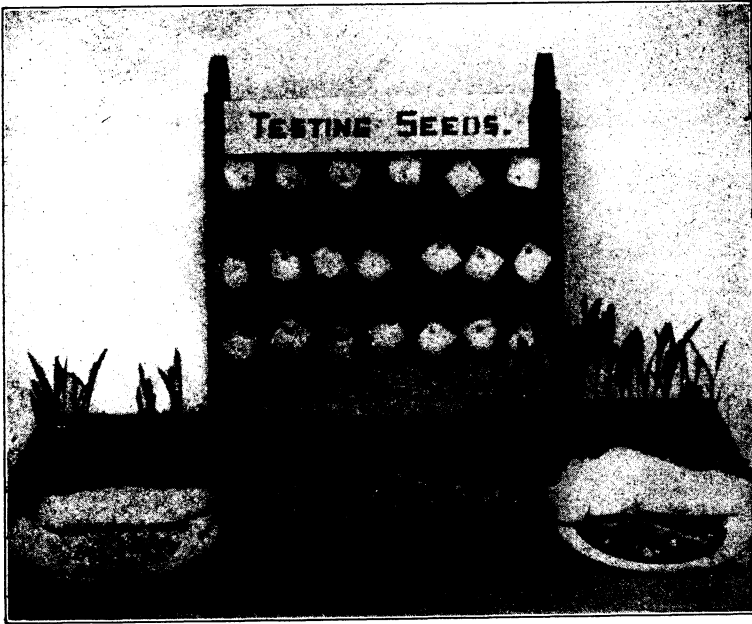
#### TESTING SEEDS.

The pupil should be taught how to test seeds. It is discouraging to attempt to raise plants from seeds that are not fertile. A few seeds of each variety should be tested. If satisfactory results are not secured at the first test, a second test should be made; then, if satisfactory results are not secured, the seeds are probably sterile and it is

useless to plant them. In these tests, few seeds need to be used. Care should be taken to see that the seeds receive sufficient moisture.

#### SEED HOUSES.

A seed house should be constructed for the protection of seed boxes in order to secure the very best results. It is essential that there be an even distribution of light and that there be sufficient warmth and moisture. While in

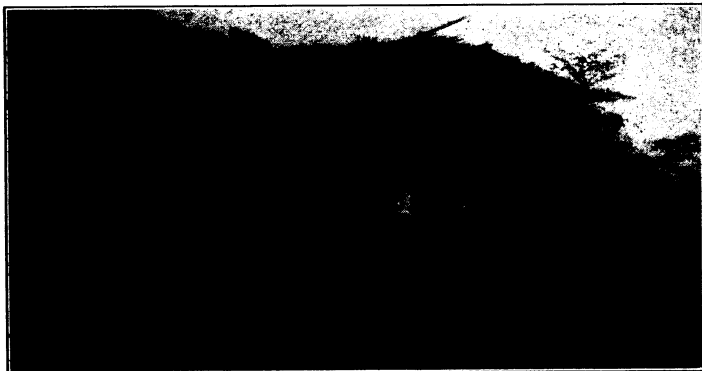


Seed testing.

many places seed boxes have been placed under houses or in closed rooms with more or less success, it is believed that the plan followed in Albay and in several other school divisions is worthy of general adoption. A small outdoor shelter is constructed so as to permit the roof to be raised. The shelter should be placed out in the open where it can get an equal distribution of light. On stormy days when the wind might injure the young seedlings the roof may be lowered and the young plants entirely protected. When



Constructing the framework of a seed house—1912 Vacation Assembly for Filipino Teachers, Manila.



Seed house constructed during the same Vacation Assembly.



Seed house with section of roof raised to admit light, constructed during 1911 normal institute, Bacolod, Occidental Negros.

the seeds first sprout only a small amount of light should be given them, but as the young plants become larger the light may be increased until they receive the full rays of the sun. The seed house must be constructed at the beginning of the school year and on days when it is impossible for the boys to do any other work in their gardens.

#### SEED BOXES.

The seed boxes contain well-prepared soil into which the seeds of small plants are sowed directly. These boxes are kept in the seed house until the plants are suitable for transplanting. When the seed house is finished, a table should be constructed upon which to place the seed boxes. It is an excellent plan to devote one box to each kind of seed. The boxes should be small so that they may be removed to places of safety during storms or carried from the seed house to the garden plots without injury to the young seedlings. They may be made at little expense in the following manner:

A petroleum case or box with the cover nailed on is sawed into two sections so as to form two shallow boxes. Care should be taken to see that the sides and bottom are securely nailed so that they will not become loosened with the weight of the soil. In the bottom of the box a number of holes are made to permit ventilation and drainage.

#### SOIL FOR SEED BOXES.

The success in securing a good growth in the seedlings depends to a great extent upon the soil of the seed box. A good soil for seed boxes is composed of one part of manure, one part of sand, and two parts of rich loam properly mixed. This should be worked up fine and sifted so that there will be no lumps. Enough soil should be prepared at one time to fill all seed boxes. A quantity of small stones are first laid in the bottom of the seed boxes. These stones are necessary for drainage and ventilation. A small quantity of sterilized soil should be used as a top dressing for the soil in the seed boxes.

### STERILIZING THE SOIL.

Soil may be sterilized in the following manner: Secure a small quantity of rich loam which has been sifted and all clods removed. Take a large frying pan and put a small quantity of soil in it; heat this for thirty minutes; have the soil about 2 centimeters deep in the pan and stir it continually until the soil bubbles, giving the impression of boiling. The soil should be sterilized in small quantities and placed in some receptacle for use as a top dressing for the seed boxes. The value of sterilizing the soil lies in the fact that weed seeds and spores of fungous growths and other destructive agencies are killed.

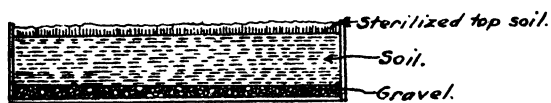
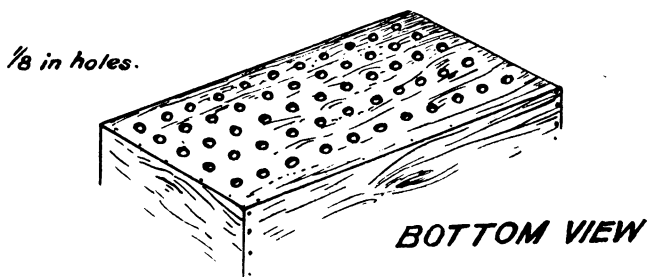
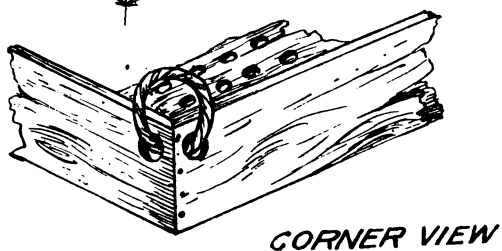
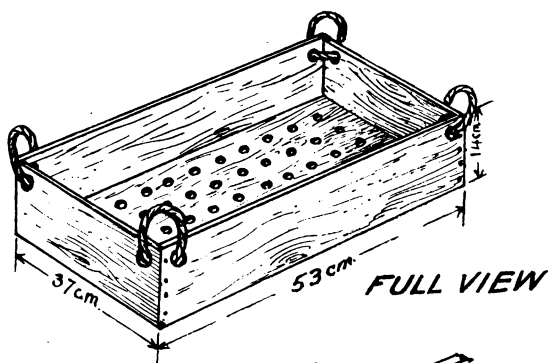
### PLANTING THE SEEDS.

Place small stones in the bottom of the box and put in soil until the box is almost full. On top of this place a thin layer of sterilized soil. Moisten the soil and plant the seeds in rows on top of the soil. After the seeds are planted cover them with a thin layer of sterilized soil. Use only enough to cover the seeds well. The seed box should be kept moist but not wet. A large amount of light is not needed until the seeds germinate, when the amount of light should be increased. The plants are not to be transplanted until they can endure the full rays of the sun. If the soil is kept too moist the growth of the plant is retarded and the young plants are apt to die. Care should be taken that just enough water is supplied to keep the young plants growing thriftily.

### PLANTS GROWN IN SEED BOXES.

The success of a garden can be greatly enhanced by making early provisions for a seed house and seed boxes in order that plants for transplanting may be available when they are needed. The following plants should be transplanted: Cabbage, tomatoes, lettuce, peppers, eggplant, pechay, mustard, beets, and endive. These plants may be grown in outside seed boxes or in specially prepared plots during certain seasons if proper and sufficient care is given the young plants. Care should be taken not to injure the roots of the young plants in transplanting; this applies





**OPEN SIDE VIEW**

especially to radishes, beets, carrots, and other plants grown for their roots. Plants grown in seed boxes must be protected from ants and other destructive agents. The legs of the seed table should be placed in cans containing water; a small quantity of petroleum may be added to prevent the breeding of mosquitoes in the water. When the plants reach the age for transplanting they should be toughened by placing the boxes in the sun a short time each day. This exposure to the sun is called "hardening off" and increases the strength and hardness of the plant. The exposure will usually assure rapid growth when the seedling is transplanted.

Plants grown in the seed boxes may be used for the following purposes:

1. For the school garden.
2. For the home gardens of pupils.
3. For distribution to the public.

It is necessary that sufficient young plants be grown. When they are large enough to be transplanted they should be given to the pupils in sufficient quantities to plant the area set aside for each plant in the home garden. It is an excellent idea to raise young plants for the public. These plants should be sold at a very nominal price rather than distributed free.

#### TRANSPLANTING.

The determination of the exact time when the different plants are ready for transplanting is the result of experience. It is impossible to give a time limit, as the condition of the soil, fertility of the seed, and the climatic conditions will influence the time required by young plants to obtain sufficient growth to withstand transplanting. It is usually safe to transplant young plants when the second pair of real leaves appear. Certain plants might remain longer in the seed boxes with proper cultivation and care and in a few instances it might be profitable to transplant earlier. A teacher should see that the young plants are not left in the seed boxes too long or that they are not transplanted too early. If the plant is transplanted before the root system begins to form the growth will be very slow. It

should be remembered that plants like carrots, radishes, beets, and others which are grown for their roots should be transplanted when small. If these are left in the seed box until the roots are formed great care should be given the transplanting, as damage to the root will result in an inferior product.

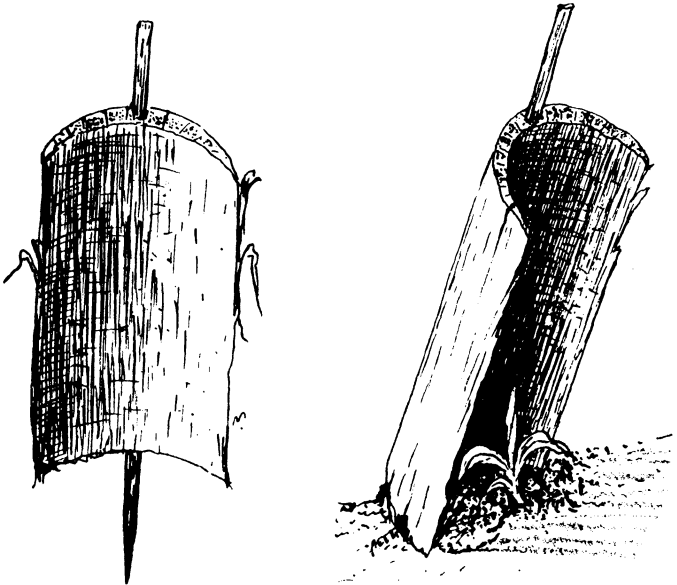
The young plants should be dug up, not pulled up, so as not to injure the tiny rootlets. Do not let them wilt or permit the roots to become dry before planting. In planting a seedling, first dig a hole with the hand deep enough for the plant, insert the seedling, and see that the roots are not twisted or doubled. The young seedlings



Batangas primary school garden, December, 1912.

should always be planted deeper in the garden than they were when growing in the germinating box. It is a good plan to set them deep enough that the earth will come up to the first leaves. The earth should be pressed down firmly around the plant, but care should be taken not to injure the stem of the plant. After the plant is set pour about one-eighth of a liter of water on it, so as to settle the soil snugly around the roots and to supply the plant with moisture. After watering, draw up the dry soil around the plant so as to cover the wet earth. This should be done every time the young plant is watered so as to hold the moisture and to keep a hard crust from forming.

When rather large plants are transplanted, it is best to pinch off some of the leaves, so that they may not evaporate water faster than the broken roots can supply it. The transplanting of young plants should always be done toward evening and the seedling or plant should be shaded for two or three days after transplanting. A very good shade can be made by taking a section of the stem of a banana plant and cutting it into pieces about 20 centimeters long. The pieces are then set up on bamboo sticks so that the



A shade for placing over a plant.

Young transplanted plant properly shaded.

young plants will not receive the direct rays of the sun from 10 a. m. to 4 p. m. Plants removed from the seed boxes should be planted at once in the plots. If they are intended for the pupils to take to their homes they should have dirt attached to the roots and should be wrapped in a piece of banana stalk. Care should be taken that these young plants are not crushed or damaged and that the boy plants them immediately upon arrival at his home. The teacher should supervise the beginners in transplanting their plants; pupils should not be permitted to do it alone

until they have received full instructions and a certain amount of practice.

### PLANTING CALENDAR.

In order that the garden may be properly started and the pupils may know the proper time to plant certain vegetables, it is necessary that a planting calendar be worked out. The table should show the season in which certain vegetables may be successfully grown. The following table has been compiled in the General Office for a certain province, although the local conditions in the different provinces will make certain changes necessary. It is expected that each school division will take this table as a basis for working out a practical local calendar.

#### *Vegetable planting table.*

A guide to the proper time for sowing various seeds to obtain a continuous succession of crops.

This table has been worked out for a single province. The variations of the seasons and general conditions of the soil are such that it may apply only in part for any other province. A similar table conforming to local conditions and containing all vegetables locally grown must be worked out for each province by the division industrial supervisor, supervising teachers, and other teachers and its use prescribed for every school.

A=Plant in seed boxes.

B=Plant in open ground without transplanting.

C=Transplant to the garden.

D=Plant only large seeds in the plot.

E=Securely fasten to stakes.

F=Set stakes or make trellises so that they may have proper supports.

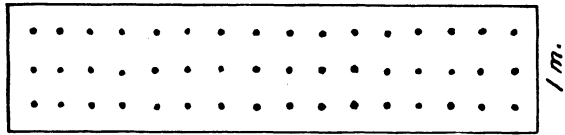
G=Plant all over the garden as a cover crop during vacation.

H=Plant sections of the root.

I=Plant sprouts or sections of the vine.

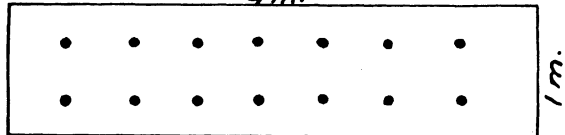
|           | June. | July. | Aug. | Sept. | Oct. | Nov. | Dec. | Jan. | Feb. | Mar. |
|-----------|-------|-------|------|-------|------|------|------|------|------|------|
| Ampalaya  | B     | F     |      |       | B    | F    |      |      |      |      |
| Arrowroot |       |       | H    |       |      | H    |      |      |      |      |
| Beets     |       |       | A    | C     | B    |      |      | B    |      |      |
| Beans:    |       |       |      |       |      |      |      |      |      |      |
| Sitao     | D     | F     |      |       |      | D    | F    |      |      | D    |
| Patani    | D     | D     | F    |       |      |      | D    | F    |      | G    |
| Batao     | D     | F     |      |       |      | D    | F    |      |      |      |
| Imp. bush | D     |       |      |       | D    |      |      |      |      |      |
| Carrot    |       |       | A    | C     | B    |      | B    |      |      |      |
| Cabbage   | A     | C     |      | A     | C    |      |      |      |      |      |
| Cucumber  | B     | F     |      |       | B    | F    |      |      |      |      |
| Cassava   |       | H     |      |       |      |      | H    |      | H    |      |
| Cadios    | B     |       |      | B     |      |      |      |      |      |      |
| Cowpea    |       | B     |      |       |      |      | B    |      |      | G    |
| Eggplant  | A     | C     |      |       | A    | C    |      |      |      |      |
| Endive    |       | A     | C    | A     | C    | B    |      |      |      |      |
| Gabi      | H     |       |      |       |      | H    |      |      |      |      |
| Ginger    |       | H     |      |       | H    |      |      |      |      |      |
| Garlic    |       | B     |      |       |      | B    |      |      |      |      |
| Lettuce   |       | A     | C    |       |      | A    |      |      |      |      |
| Mongo     |       |       |      |       | D    |      | C    |      |      | G    |
| Melon     |       |       |      | B     |      |      | B    |      |      |      |

4 m.



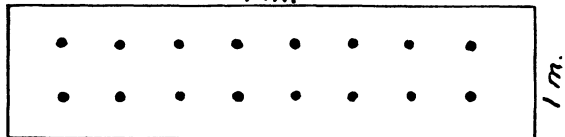
*Pechay, 3 rows - 16 Plants each.*

4 m.



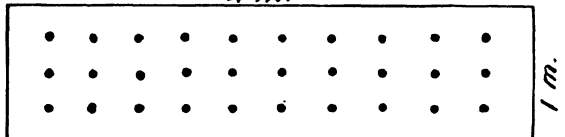
*Cabbage, 2 rows - 7 Plants each.*

4 m.



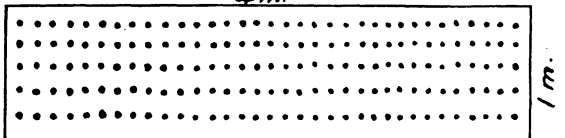
*Egg Plant, 2 rows - 8 Plants each.*

4 m.



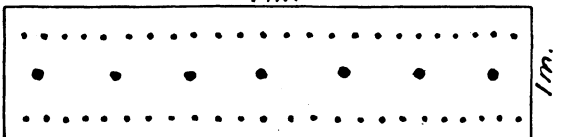
*Ginger, 3 rows - 10 Plants each.*

4 m.



*Carrots, 5 rows - 34 Plants each.*

4 m.



*Tomato, 1 row - 7 Plants.  
Radishes, 2 rows - 24 Plants each.*

Vegetable planting table—Continued.

|                         | June. | July. | Aug. | Sept. | Oct. | Nov. | Dec. | Jan. | Feb. | Mar. |
|-------------------------|-------|-------|------|-------|------|------|------|------|------|------|
| Mustard                 | A     | C     |      | A     | C    | B    |      |      | B    |      |
| Onion                   | A     | C     |      |       | B    |      |      |      | B    |      |
| Okra                    |       |       | B    |       |      |      | B    |      |      |      |
| Papaya                  | A     |       | C    |       |      | A    | C    |      |      |      |
| Peanut                  | B     |       |      |       | B    |      |      |      |      | B    |
| Parsnip                 |       |       | A    | C     | C    |      |      |      |      |      |
| Pepper                  | A     | C     |      | A     | C    |      |      |      |      |      |
| Pechay                  | A     | C     | A    | C     | B    |      | B    |      | B    |      |
| Parsley                 | A     | C     | B    |       |      | B    |      |      |      |      |
| Peas                    |       | B     |      |       |      |      | B    |      |      |      |
| Patola                  | B     |       |      |       |      |      |      |      |      |      |
| Radish:                 |       |       |      |       |      |      |      |      |      |      |
| Chinese white           | A     | C     |      |       | B    |      | B    |      | B    |      |
| Other varieties         | A     | C     |      | B     |      | B    |      | B    |      |      |
| Sweet potato (camote)   | I     |       |      |       | I    |      |      | I    |      | G    |
| Sincamas                |       |       |      |       |      |      | D    | D    |      |      |
| Squash                  | B     | F     |      |       | B    | F    |      |      |      |      |
| Tugue                   |       | H     | F    |       |      |      | H    | F    |      |      |
| Turnip                  |       |       |      | A     | C    | B    |      |      | B    |      |
| Tomato                  |       | A     | C    | A     | C    |      |      |      |      |      |
| Ubi                     | H     | F     |      |       |      |      |      | H    | F    |      |
| Winged pea (calamismis) | D     | F     |      |       |      | D    | F    |      |      |      |

## PLANTING TABLE.

In addition to the planting calendar, there should be available in every school a table showing, for each plant, the number of rows in a plot and the number of plants in a row. The table must contain this information for all vegetables grown locally along with the vegetables given in the table below.

*Directions for planting garden plots 4 meters long and 1 meter wide.*

(Rows must extend lengthwise.)

| Name of plant.    | Rows. | Plants in row. | Method of planting. | Remarks.                    |
|-------------------|-------|----------------|---------------------|-----------------------------|
| Beans             | 2     | 10             | Seeds               | Native or imported.         |
| Beets             | 4     | 25             | Seeds or transplant | Imported.                   |
| Cabbage           | 2     | 7              | Transplant          | American early variety.     |
| Carrots           | 5     | 34             | do                  |                             |
| Eggplant          | 2     | 8              | do                  | Imported or native.         |
| Endive            | 4     | 20             | do                  | Green curled variety.       |
| Ginger            | 3     | 10             | Roots or sprouts    | Native variety.             |
| Lettuce           | 4     | 16             | Transplant          | Any variety.                |
| Mustard           | 3     | 16             | do                  | Chinese variety.            |
| Okra              | 2     | 9              | Seeds               | Large variety.              |
| Onions            | 6     | 30             | Seeds or sets       | Native variety.             |
| Parsley           | 3     | 19             | Transplant          |                             |
| Peanuts           | 2     | 9              | Seeds               | Spanish variety.            |
| Peas              | 2     | 19             | do                  | Do.                         |
| Pechay            | 3     | 16             | Transplant          | Chinese variety.            |
| Peppers           | 2     | 10             | do                  | Mango, Chinese, or Chili.   |
| Radish            | 4     | 32             | Seeds               | Chinese variety.            |
| Tomatoes          | 1     | 7              | Transplant          | Imported or native variety. |
| Turnips           | 4     | 32             | Seeds or transplant |                             |
| Sweet potatoes    | 2     | 20             | Tops or sprouts     | Native variety.             |
| Corn <sup>a</sup> |       |                | Seeds               |                             |

<sup>a</sup> Do not plant in ordinary plots, but make a larger tract preferably 10 by 10 meters. Plant hills of two grains about  $\frac{3}{4}$  meter apart each way or 1 meter in larger fields.

In planting a plot use a line to make the rows straight.

Do not put the outside rows too near the edge—for cabbage 16 cm. is about right; for smaller plants 10 or 12 cm.

In connection with the time for planting a garden it may be stated that with people unacquainted with tropical gardening there prevails the idea that any plant can be grown at any season. This is not true; there is a season for each plant, and to plant it at any other time is to invite failure. With many vegetables this season is very marked, although certain vegetables may be grown in different seasons.



## Chapter V.—CARE OF THE GARDEN.

### CULTIVATION OF PLANTS.



Different kinds of plants require different methods of cultivation. Some plants, such as lettuce, pechay, mustard, endive, and cabbage, have many fine roots spreading out near the surface of the ground; consequently they should not be deeply cultivated. Other plants like radishes, beets, carrots, and turnips grow deep into the soil and should have deep cultivation in order to permit the fleshy roots to develop and enlarge. A good gardener studies his plants and gives each the care

best suited to it. After a heavy rain most soils form a hard crust. This is injurious to the plants, because the soil thereby loses much moisture. As soon as the soil is sufficiently dry it must be given a thorough cultivation.

The following rules are suggested as a guide for pupils in cultivating their garden plots:

Cultivate at least three times a week—every day if possible.

Pull the grass and weeds—do not cut them off—but be careful not to injure the plants in so doing.

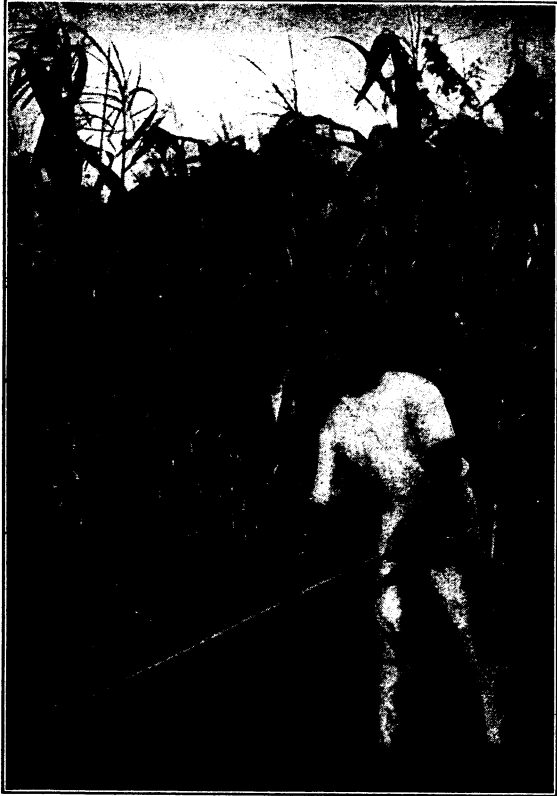
Cultivate small plants with a trowel or paddle-shaped stick.

Rake the surface smooth and fine after each cultivation.

### WATERING THE PLANTS.

There are two distinct methods of applying water to garden plants, both of which will produce good results if properly followed. One is to sprinkle the water over the leaves and tops, and the other is to dig small canals around the stem of the plants and fill them with water. The best results are secured by the first method when the water is applied in the evening, and the soil worked the next morning before the sun has time to bake the surface.

By the canal system one may irrigate at any time of the day, and there is little waste of water. If the garden is not extensive a small canal may be made with the hand around each plant and the water poured into it. The canal should be immediately filled with soil to prevent ex-



Catalino Alger, Calamba, Laguna, winner first place, contest No. 2 of the 1912 Corn Campaign.

cessive evaporation of the moisture. In this way no water touches the leaves of the plants.

Some kinds of plants require more water than others. Leaf crops require a large amount of water, and if good results are to be obtained they should be watered at least every other day. Cabbage requires more water than any

other common garden plant, and if left without water for two or three days the plants will receive a setback and inferior heads will result. The garden fruits, such as tomatoes, eggplants, and peppers, should receive water about three times a week until the blossoms begin to appear, after which one good irrigation a week is sufficient. Tomatoes require little water when fruiting; an excessive amount of moisture will cause an overgrowth of vines and a slight production of fruit. Many native root crops do well on a small amount of irrigation if the soil is well prepared and kept clean and loose so that the roots can sink deep. Onions and garlic require only a small amount of water at one time, but since these plants produce their bulbs practically on the surface of the soil it is necessary to irrigate them very often.

#### CARE OF PLANTS.

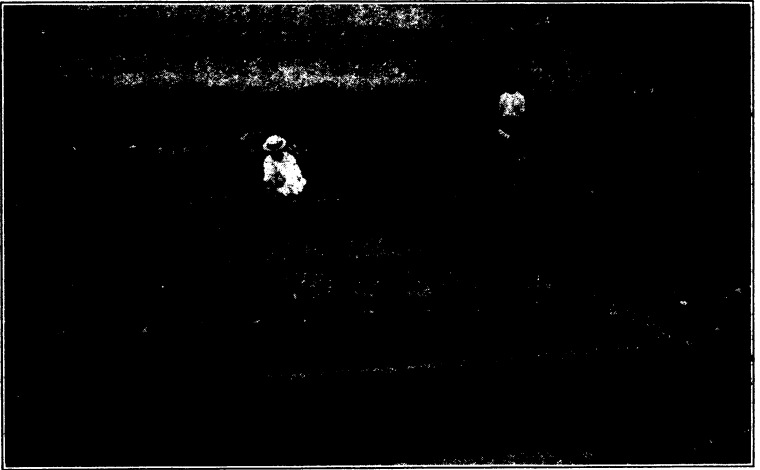
The garden must have constant care. There are numerous enemies always striving to injure the growing plants, and if the gardener does not lend his assistance the enemies will win. The greatest enemy to root crops is a hard soil. If large tender roots are to be secured the soil must be loose and mellow to a good depth. Weeds are enemies of all plants, but are greater enemies of leaf crops because such plants have a small feeding area in the soil. Carefully pull all the weeds so that the plant roots may not be injured, and give the plants all the necessary room for growth. The free passage of air through the soil is necessary; consequently a continual working of the surface soil must be kept up.

Many plants have a tendency to produce unnecessary outgrowths or suckers. These should always be removed, since they rob the plant of much valuable food. Tomato plants especially should be examined every week and all unnecessary branches removed.

#### USE OF STAKES AND TRELLISES.

There are many instances where the use of stakes and trellises in the garden will add materially to the results obtained. Care should always be taken to find out where these are needed and what is to be gained from their use.

Tomatoes should either be tied to stakes or supported by frames to keep the fruit from the ground. The following method of pruning and staking tomatoes has been found to give good results. When the plants are about 35 centimeters high they should be tied to stakes driven into the ground about 8 centimeters from the base of each plant. Beginning at the bottom, bind the vines to the stakes at intervals of about 12 centimeters till the top of the stake is reached, which should be between 70 and 80 centimeters above the ground. Prevent the vine from growing higher than the stake by pinching off the top bud when the proper



A public school garden properly laid out and partially planted, Nagcarlan, Laguna.

height is reached. Prune the plants so that each vine consists of three or four strong healthy branches, and remove all unnecessary outgrowths and suckers.

For climbing beans and yams there should be a separate support for each vine, as this will more readily permit cultivation and the removal of unnecessary growths. Pinch off the growing end if the vine shows a tendency to make a too profuse growth and the plant will produce fruit instead of many leaves and branches.

The best rule to follow in the case of stakes and trellises is to use them only when it is absolutely necessary. Always

trellis a plant so as to give the least trouble in cultivating and gathering the fruit. Unsightly structures in the garden should be avoided.

#### PROPER TIME FOR GATHERING VEGETABLES.

The pupil should form the habit of going over his garden to study the proper time for harvesting. He must not get



First prize winner, contest No. 1 of the 1912 Corn Campaign.

in a hurry and pull the fruit before the proper stage is reached. It is better to gather eggplants and tomatoes just before they reach the ripe stage and allow them to ripen in the shade; much is lost if the cabbage head is taken before it reaches its full growth; peppers are better when green if desired as a vegetable, but if for seasoning they should ripen on the plant; turnips and radishes become

strong and unsuitable for food if left in the ground after they have reached full growth, and consequently they should be pulled before becoming fully grown, when they are sweet and tender; green beans should be picked before the pods are matured in order to avoid tough stringy pods; lettuce becomes bitter when the seed stalk begins to develop, and should be gathered earlier; okra should be picked when the pods are young and tender. Not only is it necessary to know how to grow the different plants, but it is just as important to know when to harvest and how to prepare them properly for the table.

#### PLANTS FOR SEED.

Pupils should be required to produce seed for their own use. When they buy seed from the store or a seed merchant they do not know whether it is pure or not, but they can be sure of getting pure seed if the strong healthy plants in their gardens are set apart and reserved for seed purposes. It is well to remember that it is not always best to choose seed from plants which grow extra large fruits. A plant which bears a large number of medium-size fruits is much better than a plant which produces only a few very large ones. Medium-size roots are better to select as seed producers than large, badly formed ones. Always avoid selecting seed from plants which show any weakness.

#### VALUE OF CLEANLINESS.

Not only is a clean garden pleasing to the eye, but it is essential for the proper growth and development of the plant. A clean garden is an enemy of destructive insects and fungi. Rubbish heaps are the breeding places of numerous insects which feed upon the most valuable plants. The teacher should require the pupils to keep their home gardens and the school garden clean and in an orderly condition at all times. Rubbish should not be disposed of by throwing it over the garden fence. The teacher must see to it that, where possible, the ground around the garden is kept clean at least 1 meter from the fence.

## THE CONTROL OF PLANT ENEMIES.

The insects and diseases which attack garden plants may be grouped roughly under four headings:

1. Insects which bite or chew their food, such as the ordinary beetles and cabbage worms. They may be controlled by the application of dry lime, tobacco dust, or ashes to the foliage.

2. Insects which puncture the surface of the plant and secure their food by suction, such as plant lice and scale insects. They are most readily destroyed by external applications of tobacco water or kerosene emulsion.

3. Parasitic fungi which attack the leaves or stems of the plants and cause them to become spotted, such as the various leaf blights, mildews, or rusts.

4. Diseases caused by germs or microbes. The remedies are timely pruning and the rotation of crops.

In combating plant enemies, success depends largely upon taking prompt action when the enemy first appears. One of the best remedies for certain plant enemies is hand picking; caterpillars, some kinds of beetles, and the eggs of insects can be picked off with little difficulty and it is the best way to dispose of them.

The rotation of crops and the growing of different kinds of vegetables which are not likely to be attacked, with thorough cultivation, are probably the best methods of combating the insects and diseases that attack the roots. Young seedlings may often be protected by placing around them either empty tin cans with tops and bottoms removed or sections of bamboo. Destructive beetles may be destroyed by light traps. A light is put in the garden at night and under it is placed a large pan containing a weak solution of kerosene.

A good remedy for many plant enemies, such as plant lice and soft-skinned caterpillars, is tobacco dust. This should be thoroughly sprinkled on both sides of the leaves when they are wet with dew; lime, ashes, or fine road dust will serve the same purpose in many cases. Care should be taken that the preventive does not get on the blossoms or it may prevent the plant from setting fruit. A good way to sprinkle dust on plants is to place it in a bag made of

sinamay or other loosely woven cloth, and shake it over the plants until they are covered.

Kerosene emulsion is a valuable insecticide. It kills by contact and is used especially to destroy sucking insects, but also kills many biting insects. It is made of the following ingredients:

|                                      |            |     |
|--------------------------------------|------------|-----|
| Hard soap, cut into fine pieces..... | grams....  | 250 |
| Kerosene .....                       | liters.... | 4   |
| Water .....                          | do.....    | 2   |

Dissolve the soap in boiling water, remove from the fire, and add the kerosene while the water is still hot; stir rapidly until the mixture is well worked together and until a cream-like emulsion is secured. If the kerosene is not well worked with the soap and water it will injure the plants. To use, place 1 liter of the mixture in 12 liters of water, stirring them well together. The plants troubled with insects or caterpillars should be sprayed with the diluted emulsion every two or three days.

Tobacco water, made by boiling 1 kilo of tobacco stems, leaves, or dust in 10 liters of water for twenty minutes, will serve practically the same purpose as the kerosene emulsion.

Teachers and pupils should form the habit of observing and studying plant enemies and of finding remedies for them. Record should be made in the teacher's permanent record book of all insects and diseases which attack the plants in the locality.

#### USE OF POISONS.

Poisons used in preparing insecticides are not usually advisable, as some risk is incurred in their use. In most cases plant enemies can be held in check without them and their use is not recommended for school and home gardens of primary pupils.

#### DISPOSITION OF DISEASED PLANTS.

There are certain fungous diseases which attack the roots and less exposed parts of the plant, and which it is almost impossible to cure. In cases of this kind the plants should



be removed from the garden and burned to eliminate the disease. The soil where the plants grew should be sterilized by pouring boiling water over it to kill the bacteria which injured the plants. New plants should then be set out in the places of those removed. When it is found that a certain kind of plant is continually attacked by a root disease the only remedy is to plant another kind of vegetable in the infected ground. A diseased plant should never be pulled up and placed where it will communicate the disease to other plants, but should always be destroyed. Sometimes plants will be found to die from "plant rot." In this case the affected plants should be removed and burned and the soil where they grew should be sterilized.

#### CULTURAL DIRECTIONS FOR SOME COMMON VEGETABLES.

##### BALSAM APPLE (AMPALAYA).

The ampalaya (amargoso) is an edible gourd. It is especially adapted to the rainy season and will grow well in almost any kind of soil. The seed should be planted in holes well filled with a mixture of rich soil and stable manure. The planting should be done at the beginning of the rainy season. Ampalaya grows best when trained over a high trellis.

##### BEANS.

For cultural purposes beans may be divided into two classes—dwarf beans and pole beans.

(a) *Dwarf or bush beans*.—Dwarf beans are an earlier variety than pole beans and require no support.

(b) *Pole beans*.—Pole beans require a much longer time to develop than the bush variety. They are grown on poles or trellises and one plant will often cover a large area. The common garden pole beans are usually supported by single stakes about 2 meters in height.

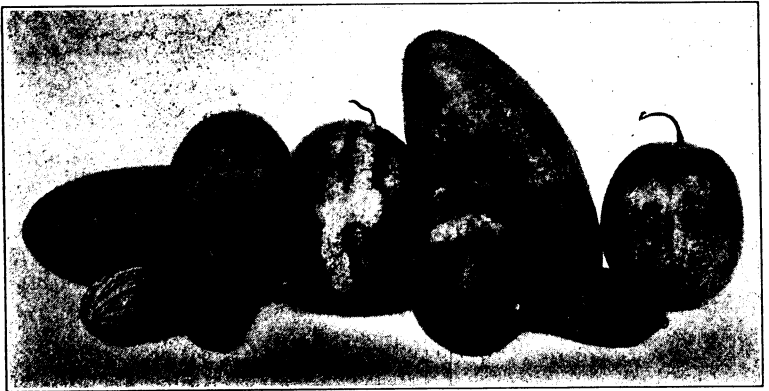
There are varieties of beans suited to almost all varieties of soils. A clay soil can often be transformed into one fairly loose and pliable if beans are grown on it for a few seasons. If there happens to be a poor spot in the garden, it would be well to grow beans on it for a while. Do not



Legumes displayed at the 1913 agricultural exhibit of the Bureau of Education.

touch or brush against bean plants when they are wet, as it is likely to cause them to become diseased.

The patani is a large flat bean resembling the common lima bean. It requires a stake or trellis, and, if properly cared for, will live and produce for several years. Patani may be planted at any season of the year if there is sufficient moisture to start the plants well.



Melons.

## BEETS.

Beets grow best in a loose, sandy loam. Some varieties produce thick, fleshy roots near the surface of the soil, while others grow long and slender roots which resemble the white Chinese radish in shape and size. The first variety is extensively grown, as it is more easily cultivated. The soil for beets should never be allowed to harden or become caked or the roots will become knotty and badly formed. Constant cultivation is necessary to produce large, tender roots in a short space of time. Beets should follow some crop for which the soil has been well fertilized, as fresh manure causes the roots to become irregular in form.

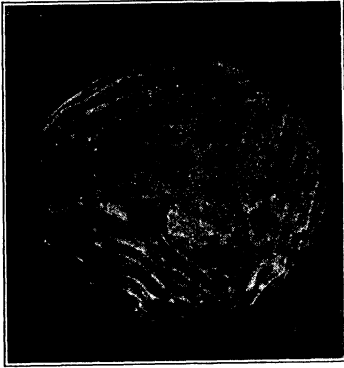
## CABBAGE.

Cabbage is the most valuable of all the leaf crops. While it is rather difficult to grow in the Philippines, a good crop can usually be secured if a few very important cultural directions are followed.

Cabbage requires a very rich soil and uniform moisture. A good loam well mixed with stable manure is the best soil for successful cabbage growing. The loam and manure should be thoroughly mixed to a good depth and should never be allowed to become dry. A daily supply of moisture is necessary; a lack of sufficient water is sure to prevent heading, though too much water is just as injurious. The planting should be timed to let the plants develop during the dry season.

Cabbage should be continually cultivated, and the surface of the soil mulched so as to keep it cool. It is a good plan to set the plants sufficiently close together so that they will shade the ground completely when full grown.

There are many enemies of cabbage in the Philippines; the worst of these is the common cabbage worm. The moths, of which these worms are the larvae, visit the plants at night and deposit their eggs on the leaves. In a very short time the eggs hatch and the worms soon attack all parts of the plant. If tobacco dust, lime, or fine road dust is kept sprinkled over the leaves until the plants are almost full grown there will not be much danger from the



Prize cabbage, winner first prize at the 1912 agricultural exhibit, Bureau of Education.



Onions raised by a public school pupil.

worms. Kerosene emulsion sprayed over the plants is also a good remedy. Where the number of plants grown is not large the worms may be picked by hand.

Cabbage often has a tendency to put out numerous shoots. This is caused from a lack of moisture or cultivation, and can be prevented by giving the plants constant care.

For cultural purposes cabbage is divided into two distinct classes—the early and the late. Of the first, the principal varieties are the Jersey Wakefield, St. Johns, and Burpee's All Head; of the second, the best are the Flat Dutch, Drum-



Papaya.



Pechay raised by a public school pupil.

head, and St. Louis Late Market. Both of these varieties are standard and under normal conditions with sufficient attention fair results should be secured with them.

#### CADIOS.

The cadios is a bush legume which bears a short pod of edible beans. It should be planted at the beginning of the rainy season so that it may be harvested in the dry season. The soil should be rich and loose so as to promote a strong, rapid growth. The beans should be used while green.

#### CARROTS.

Carrots are grown for their roots. They are rather difficult to grow and it often requires as many as sixteen days for the germination of the seed. The soil should be very fine and mellow and should be kept moist until the seeds have germinated and the young plants are well started. The soil should not be fertilized near the surface or the roots will become knotty and forked and of inferior quality.

#### CASSAVA (CAMOTENG-CAHOY).

The cassava produces a long, slender root which contains a large amount of starch. It is widely distributed and used for food when there is a scarcity of other food products.

Cassava is propagated by means of root sections. It grows best in a sandy loam soil, and is especially adapted to the rainy season.

#### COWPEAS (PAYAP).

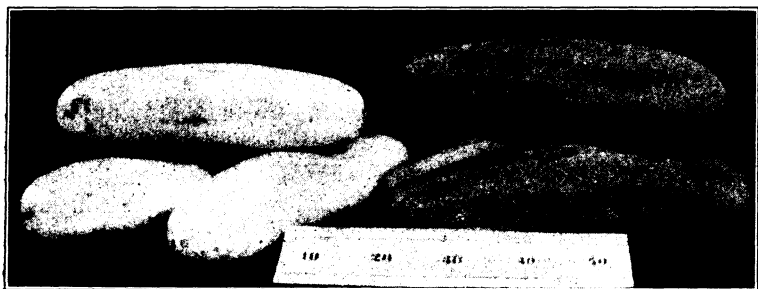
The cowpea (payap, sitao) is a legume resembling the mongo, though producing longer pods and larger peas. It is perhaps the best legume in the Philippines for enriching the soil. Cowpeas produce better vines during the rainy season, though they seem to develop more pods during the drier months than at any other time. The green pods and the dry seeds are cooked and eaten. The tops make good fodder for animals. The soil may be enriched by planting cowpeas at the beginning of the rainy season and turning them under after about three months' growth.

## CUCUMBER.

The cucumber belongs to the gourd family, and is grown in almost all parts of the Philippines. It responds quite readily to care and fertilization. The soil should be loose and mellow and mixed with a good supply of well-rotted manure. In the Philippines cucumbers usually require trellises or supports. The vines climb readily over fences and brush heaps, and seem to do better during the rainy season than at any other time of the year.

## EGGPLANT.

The eggplant in the Philippines is divided into two classes—the native and the imported. If the young plants



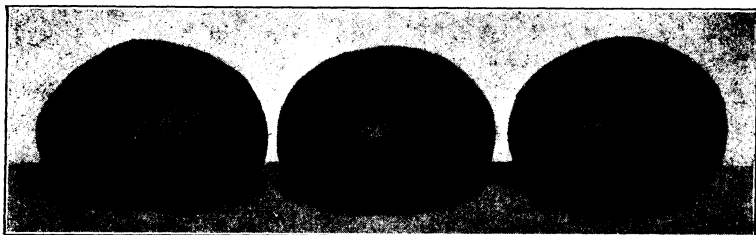
Cucumbers grown in a school garden—1913 agricultural exhibit of the Bureau of Education.

are protected until they get a good start, the native variety will grow during the rainy season.

The soil for eggplants should be loose and mellow. During the dryer months the surface soil should be well worked in order to prevent evaporation. In some localities of the Philippines plant lice are very destructive enemies of young plants. They sap the leaves and cause them to curl up. A good remedy is to sprinkle tobacco dust or lime over the leaves frequently until the plants have reached a good growth.

## ENDIVE.

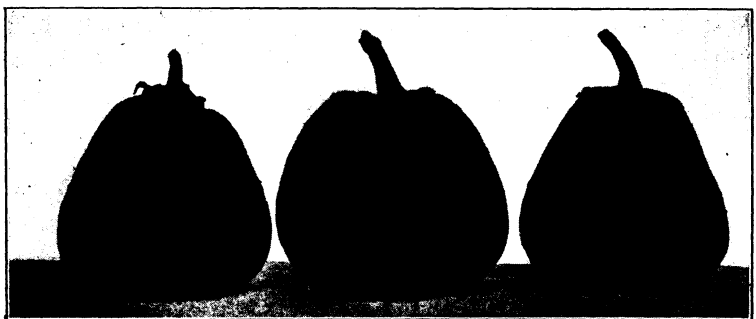
The endive is a leaf crop resembling lettuce, and is propagated in the same way. When the plants are ready for use the leaves should be bound together in a head to bleach them and make them tender.



Tomatoes, winners first prize—1913 agricultural exhibit of the Bureau of Education.



Eggplants of different types—1912 agricultural exhibit of the Bureau of Education.



New York improved eggplant, winner first prize—1912 agricultural exhibit of the Bureau of Education.

## GARLIC.

Garlic is grown from sets and requires a loose, sandy loam. The planting should be done at the close of the rainy season when there will be constant but gentle showers. Garlic will not endure heavy rains, but requires a continual supply of moisture.

## GINGER.

Ginger is a rainy-season root crop and does best in a loose, sandy loam. It is propagated by means of small rootstock sections.

## LETTUCE.

Lettuce requires a loose, mellow soil. If well-rotted stable manure is mixed with a loamy soil the plants will make a rapid, healthy growth. It is necessary for lettuce to grow rapidly in order to produce tender leaves. When lettuce is ready for use it should be shaded a few days in order to permit the plants to become tender. It is possible to grow lettuce during the dry season if it is shaded during the hot hours of the day.

## MELONS.

Melons require a loose, sandy loam rich in nitrogen. Before the seed is planted the soil in the holes should be well mixed with stable manure. Melons will grow well only during the cooler months of the year. The soil around the base of the vines should be kept well mulched with straw or grass.

Squash bugs are usually bad on melons, but these may be kept off by keeping the young plants well dusted with tobacco powder or lime.

## MONGOS.

The mongo is a bush legume which produces long, slender pods of small peas. It is usually grown during the rainy season, although it may be planted at almost any time of the year. It makes an excellent crop for the garden during the rainy months for the vines can be plowed under when the rainy season is over, thus making the soil rich in nitrogen for the other garden crops. Mongos grow well in nearly all kinds of soil.



## MUSTARD.

Mustard is a leaf crop and may be grown during either the rainy or dry season. There are several varieties; some are grown only for the seeds, which are used either for medicine or for food, others are grown for their pungent leaves, and others for their large, succulent leaves. The last kind is the one commonly grown in the school gardens.

Mustard grown for the leaves should be forced to grow rapidly. The soil should be made rich with manure and, during the dry months, should be mulched with grass or straw.

## OKRA.

The okra is a tall bush legume grown for its pods. At present its food value is little appreciated by the Filipinos.

Okra is a hardy plant and will grow during nearly all months of the year, though it seems to be best suited to the rainy season. While okra does well on most soils, a rich, loamy soil will produce a better supply of pods than any other. The pods should be used when half grown.

## ONIONS.

In the Philippines onions are usually grown from sets that are in most cases secured from China.

Although it is generally believed that onions cannot be grown from seed in the Philippines, yet if a few proper precautions are taken the seed will germinate easily. The germinating bed should contain a rich soil well mixed with sand. After the seeds have been sown in the bed, they should be covered with a cloth, sheets of paper, or straw, for several days. The seed should be kept completely in the dark until after germination. At the end of a week the covering should be removed, but the bed should be kept shaded. Gradually permit the sun to reach the plants by removing a part of the shade every few days. The plants will be ready for transplanting when they are five weeks old.

Since onions grow near the surface of the ground they should receive shallow cultivation and a constant supply of moisture; however, an oversupply of water is injurious. Onions do best during the cooler months. The soil should be loose and mellow, and should be kept mulched.

## PAPAYA.

The papaya, though not a garden vegetable, is treated here because it is in reality a garden plant. The papaya is one of our most valuable fruits owing to its power of aiding digestion. There are few plants which respond more readily to care and cultivation. Before the removal of the plants from the seed bed the holes should be prepared large and deep, and then filled in with rich loam mixed with stable manure. It is important that the young plants be transplanted with great care or they will receive a setback which will require several weeks to overcome. It is best to transplant papaya at the beginning of the rainy season.

## PARSLEY.

Parsley is grown for its stems and leaves. It requires a rich mellow soil, and may be grown during the rainy season, though it seems to do best during the cooler months. Parsley should be used while young and tender.

## PARSNIP.

(Refer to cultural directions of carrots for proper methods of growing parsnip.)

## PATOLA.

The patola is a large edible gourd. It requires a trellis and should be planted at the beginning of the rainy season. The hills should be well enriched with stable manure.

## PEAS.

Peas are garden legumes which are divided for cultural purposes into two classes—dwarf peas and stick peas.

*Dwarf peas.*—Dwarf peas grow and develop much more quickly than the stick peas and require no stakes or trellises.

*Stick peas.*—Stick peas are slow growers and require supports. These supports may be made of single stakes or in the form of frames constructed from split bamboo. Brush makes an excellent support for peas.

The soil for peas should be loose and rich and should be kept cool at all times by means of a mulch. Most varieties of peas do not endure the heat well and should be grown during the cooler months.

## PEANUT.

The peanut is a legume which produces its pods under the ground. Peanuts may be grown during all seasons of the year and should have a soil fairly loose and sandy. The peanut tops make excellent food for animals.

## PECHAY.

Pechay is a leaf crop slightly resembling the cabbage, some varieties producing loose heads. It is quite hardy, but for the best results it should have a mellow soil well enriched with stable manure. Pechay may be grown during the rainy season, but the plants should be protected from



Peppers grown in public school gardens.

hard storms. The large succulent leaves are used, but only a few leaves should be cut off at a time so as to allow the plant to continue its growth. Pechay may also be grown during the dry season. It is often troubled with the same diseases and enemies as cabbage and should receive the same treatment.

## PEPPERS.

Peppers are usually treated as garden fruits, and are divided into several different classes. The large varieties require a deep, rich soil. The small, piquant varieties will do well on most soils and may be grown at all times of the year. If the plants are well protected from storms, large mild peppers may be grown during the rainy season, though

they will produce larger and better fruit during the cooler months. When peppers are grown during the dry season the soil should be kept well mulched with grass or straw.

#### RADISH.

There are several varieties of radish, all of which require practically the same cultural directions. The variety which seems to do best in the Philippines is the Celestial or White Chinese. Radishes require a deep, mellow soil, but the soil must not be too rich in nitrogen or the roots will be badly formed. They may be grown during the rainy season if the plants are protected till they get a good start, although they grow and develop better during other months.

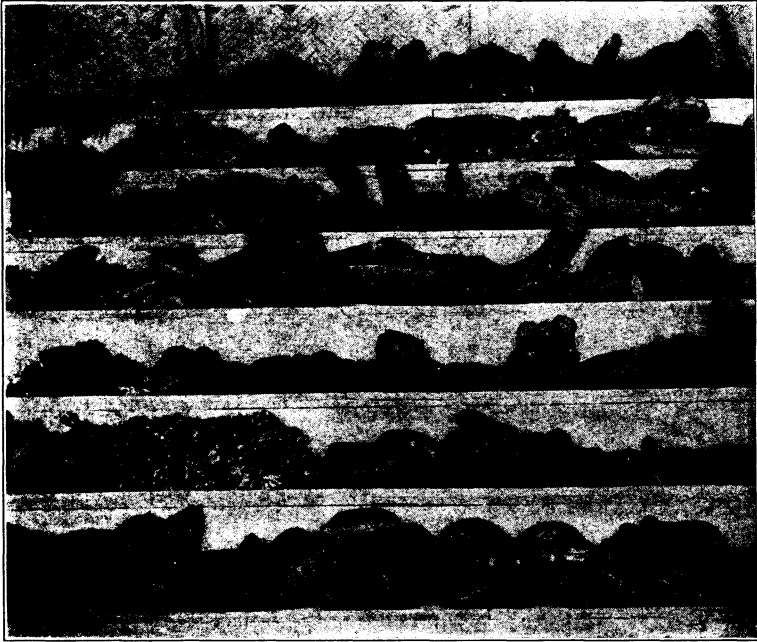
#### SINCAMAS.

Sincamas is an edible root with a vine that trails on the ground the same as the camote vine. Sometimes it is trellised. Several roots are produced in one hill. A large quantity of sincamas is grown during the dry season, as it is distinctively a dry-season plant.

Almost any good, rich, loose soil is adapted to the growing of sincamas, although it is contended that the soil does not need to be exceedingly fertile to produce good crops. The sincamas are reproduced by seeds which are planted in the place where wanted. These seeds are secured in a manner differing somewhat from the usual method of securing seeds in the Philippines. When the crop of sincamas is harvested, the largest and best roots are hung up in some part of the house or stable where they will not be damaged by rats. In about sixty to ninety days these roots will dry up considerably and will send out young shoots. They secure from the air sufficient moisture to start growth. As soon as these shoots begin to grow the entire root is taken and planted in rich soil. It is given all possible attention and a stake supplied for the vine. The vine grows rapidly and profusely. In about forty days a large number of pods containing many seeds are produced. These seeds are later planted in the field. Sincamas seeds are usually planted about 15 centimeters apart in rows 70 centimeters apart and cultivated until the vine begins to cover the ground.

## SQUASH (CALABASA).

Squash will grow well in the Philippines during all seasons. These plants require a large amount of nitrogen, and the hills where the seeds are to be planted should be well mixed with stable manure. Where the young plants are troubled with squash bugs, the insects may be kept off by continually sprinkling tobacco dust or lime over the leaves. Squash plants should not be permitted to support



Varieties of native roots grown in school gardens, displayed at the 1913 agricultural exhibit of the Bureau of Education.

more than three strong vines; care in preventing profuse growth will improve the quality and increase the size of the product. Squash may be grown over a trellis or without a support.

## SWEET POTATO (CAMOTE).

The sweet potato, or camote, does well at any time of the year, though it is especially adapted to the rainy season. A loamy soil containing considerable sand is especially good

for camotes. During the rainy season the soil should be worked up into ridges. This will give the roots a better opportunity to spread than they would have if grown on level ground.

Camotes are propagated from cuttings or sprouts. Where the first method is used the vines are cut into small sections and these sections are dropped into holes and about half covered with soil. If sprouts are desired, large, smooth roots are planted in a bed composed of very rich soil, and after a few weeks the roots will send out shoots which may be broken off and planted in the same way as the cuttings. The latter method will usually produce better roots than the former.

#### TARO (GABI).

There are two varieties of taro, one of which is adapted for growing in very wet places and will thrive fairly well in ground that is covered with water a part of the time. The other variety is grown in rich, loose soil. The latter variety is commonly planted on well-drained, newly cleared land.

The plants are usually set one-third of a meter apart when grown in low, marshy land and in the beds of small streams. The variety grown on dry land is set one-fourth meter apart in rows 1 meter apart. The plant should be given thorough cultivation for best results.

Gabi is propagated from the small parts of the roots which grow on the main root. These are removed from the main root and planted.

#### TOMATOES.

Tomatoes hold first place among all our garden fruits. They require a loose, mellow soil, but if the soil is too rich in nitrogen there will be a large growth of vines and a small amount of fruit. It is quite important that tomato plants receive a good start from the outset if strong, healthy plants are to be produced. They should receive an ample supply of moisture and continual cultivation till the fruits begin to set; then a small amount of water is necessary. Not more than three strong branches should be permitted to grow on each plant, and the tops should be kept pinched

back. Tomato vines should be fastened to stakes or trellises, and should not be permitted to grow more than 80 centimeters high. Suckers and other outgrowths should be removed.

#### TUGUE.

Tugue is another species of yam. There are several varieties, ranging in color from pure white to purple. The flesh of the tugue is much finer than that of the ubi. The roots vary in weight, but sometimes weigh as much as 1 kilo. Tugue is usually planted 1 meter apart in loose soil. The plant is a vine and a support is needed. The plants are propagated by sections of the root. The entire section is sometimes planted, though the most common method is to divide the base section and to plant the pieces where desired. By a base section is meant the part of the root near its point of contact with the stem.

#### TURNIPS.

Turnips grow well only during the cooler months. The soil should be a sandy loam, not too rich in nitrogen. Turnips must have a constant supply of moisture and the soil should be kept cool by means of a mulch, or the roots will become strong. The roots are better if used before they become full grown.

#### UBI.

Ubi is one of the largest yams. The top part of the ubi plant is a vine and needs a support; the root is used for food. This root varies in color from white to purple. Loose, rich, well-drained soil is the best for ubi culture, although fair results may be secured on any loose soil. Ubi is usually propagated by the sections of the base end of the root. Ordinarily one or more vines will grow from the base section. Sometimes the root is cut into sections and each piece planted.

#### WINGED PEA (CALAMISMIS).

The calamismis (sigadillas) is a legume which bears a long tender pod. It is well adapted to the rainy season, and if given ordinary care will produce a good crop. It requires a trellis for support. The young pods are prepared for food the same as the pods of beans.

## SPECIAL NATIVE ROOTS.

The nami and pakit are native roots which will grow well during all seasons of the year, but do especially well during the rainy months. The nami and pakit, as well as the ubi and tugue, produce long vines which require supports and should be trained upon poles. These roots are propagated by means of roots or root sections in much the same manner as the tugue.



## Chapter VI.—PRODUCTS OF THE GARDEN.

### THE PUPIL'S RIGHT OF OWNERSHIP.



It is important to impress upon the mind of each pupil the fact that he is the owner of the vegetables under his care. He should be made to feel the responsibility for his plants as owner, so that he will take a genuine interest in them. A pupil who cares for plants merely because he is required to do so in order to make a passing grade will not put his best effort into his work. The desire to produce vegetables and to provide better and more food should be the main incentive.

#### EXCHANGE OF VEGETABLES.

Pupils should be encouraged to exchange vegetables with each other in order that all may have a greater variety, and to avoid the possibility of any boy's surplus vegetables going to waste. For example, one boy may exchange a part of his pechay with another for radishes or mustard. Even when surplus vegetables can be sold readily, it is much better for the owner to exchange them for another variety.

#### USE OF VEGETABLES.

The teacher will frequently find that his pupils are not familiar with the use of many of the vegetables raised in their gardens. It will, therefore, devolve upon the teacher to give instructions upon the preparation and use of such. Pupils soon learn to use pechay, cabbage, and lettuce; but to teach them the good qualities of okra, endive, radishes, and some other imported varieties requires special attention. Vegetables should be prepared in different ways and served to the boys in the gardening class. Special demonstrations showing the uses and methods of preparing vegetables

should be held to which the parents and people of the community should be invited. The boys should also be taught a few simple ways of preparing the vegetables they raise. Every gardening pupil should copy in his notebook one or two suitable recipes from Bulletin No. 35, Housekeeping and Household Arts, for preparing each vegetable which he has raised. Vegetables which are not liked by the pupils should not be raised in large quantities. Native vegetables and vegetables similar to those with which they are familiar



Ubi, a Philippine yam—Note the profuse growth of vine and method of staking.



Papaya tree in fruit.

should be given preference, such as beans, tomatoes, eggplant, onions, pechay, mustard, ubi, tugue, etc.

#### FOOD VALUE OF LEGUMES.

Beans and peas are two of the most important legumes, several varieties of the former being found in all parts of the Islands. Legumes are richer in food properties than are any other vegetables. They should always be well cooked. Legumes should be extensively planted in home and school gardens.

## GATHERING SEEDS.

The saving of seeds for the next year or the next planting is a very important feature of gardening and should receive the careful attention of the teacher. Seeds can be saved successfully from practically all varieties of vegetables raised by the pupils. Plants from which seeds are to be saved should be given special attention—only strong healthy plants should be selected. Not more than ten or fifteen plants of lettuce, mustard, pechay, and similar vegetables should be allowed to produce seed in one plot. Each plant should be tied to a stake to prevent it from falling down from the weight of the seed or from being blown over by the wind. Only mature fruits should be picked for seed. If the seeds are covered with pulp or fruit juice after removal from the fruit they should be washed and thoroughly dried. Worthless seeds of some varieties may often be separated from the good ones by placing them in a pan of water and stirring them for a few seconds; the worthless seeds will float on the water and should be thrown away; the others should be taken out of the water immediately and placed in the sun to dry. This should be done only when the sun is shining so that the seeds will dry quickly. Light and worthless seeds may often be separated from the others by winnowing.

## HOW TO KEEP SEEDS.

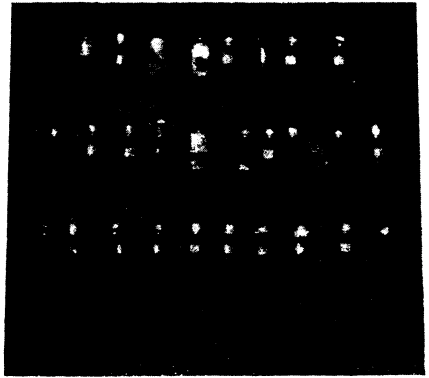
After the seeds are thoroughly dried they should be placed in glass bottles or jars with a layer of dry pulverized charcoal on top equal to about one-fifth of the amount of the seed. The bottle or jar should be tightly corked. The charcoal helps to preserve the seed by absorbing the moisture and certain gases that may be produced by the seeds. If the charcoal contains any moisture it should be dried over a fire, but it should not be put on the seeds until it is cool. The use of damp charcoal will cause the seed to spoil. Seeds that are to be kept only a short time before using may be kept in bottles without charcoal if well corked, but seeds that are to be kept from one school year to the next should be stored with the greatest of care. Lettuce, tomato, carrot, and beet seeds are especially hard to keep.

All bottles in which seeds are kept should be stored in a cool, dry place. The bottles should be examined, without being opened, about once a month to see if they have been attacked by fungi or insects. In case any fungous growths or insects are seen, the bottles should be opened and the seeds should be thoroughly dried in the sun and placed in fresh charcoal. The teacher should personally supervise the harvesting and storing of seeds by his pupils.

Large seeds, such as corn, beans, peas, and squash, should not be placed in charcoal but should be stored in uncorked bottles, jars, or tin cans, with a cloth securely tied over the top to keep out insects. They should be thoroughly



Seeds properly stored with charcoal.



Garden seeds stored in tightly corked bottles.

dried in the sun before being stored; artificial heat should not be used in drying seeds. The jars or cans in which the seeds are stored should be placed where they will not be molested by rats or mice. After the seeds are properly bottled and marked with labels giving the name of the producer, variety, and school, the teacher should collect them and turn them over to the responsible teacher or principal to be kept as school property until the next school year.

#### GARDEN RECORDS.

Each gardening pupil should be required to keep a record in a notebook of all he does in gardening during the school year. The teacher should inspect the notebooks once a week to see that they are properly kept and he should grade them each month. The following records should be kept:

Notes and instructions as to the laying out of the school and home gardens, preparation of plots, fencing, etc., which the teacher has copied on the blackboard; recipes for preparing vegetables; also instructions about seeds, plants, and soils; date of planting; enemies and methods of combating them; amount of products harvested, value of the crop, and the amount of sales, if any, for each vegetable planted. A pupil should be required to place on a separate page the record of each crop for each plot in his school and home garden.

## RECORD TABLES.

*Specimen page—Pupil's plant record.*

Name of plant: Radish, Chinese White.

### PLANTING PLAN.

4 meters.

1 meter.

4 rows—32 plants in each row.

| Month.          | Date planted. | Amount harvested. | Value of harvested products. | Money realized from sales. | Grade for the month. |
|-----------------|---------------|-------------------|------------------------------|----------------------------|----------------------|
| June .....      |               |                   |                              |                            |                      |
| July .....      |               |                   |                              |                            |                      |
| August .....    |               |                   |                              |                            |                      |
| September ..... |               |                   |                              |                            |                      |
| October .....   |               |                   |                              |                            |                      |
| November .....  |               |                   |                              |                            |                      |
| December .....  |               |                   |                              |                            |                      |
| January .....   |               |                   |                              |                            |                      |
| February .....  |               |                   |                              |                            |                      |
| March .....     |               |                   |                              |                            |                      |
| Total .....     |               |                   |                              |                            |                      |

A similar record should be kept for each kind of vegetable grown in the garden.

Every teacher should keep a record of what has been done in gardening during the year. This should be kept in a ruled composition book and should be known as "The school record in gardening." The book must be handed in

to the supervising teacher at the close of the year to be issued the following year to the gardening teacher in the same school. Such records should be issued on receipt and should form a part of the permanent records of the school. These records should consist of:

1. The ratings of pupils based on (a) the pupil's success as determined by his monthly grade during the year; (b) the vacation plans for the home garden; (c) attention the pupil has given the saving of seeds.
2. The total amount of vegetables raised.
3. The results secured with each variety.
4. Cultural notes.
5. Entire value of garden products.
6. The amount received from the sale of vegetables.
7. The number of plots and the entire area cultivated by the pupils.

It is believed that the following form will furnish the easiest method of keeping an accurate record of the grades of each pupil during the entire year. In the last column under "Grade for the month" will be entered the average of the three grades given for gardening. This grade will be the one entered in the school records.

*Specimen page—Teacher's record of grades.*

Name of pupil .....

Academic grade .....

| Month.                   | Home garden grade. | School garden grade. | Grade for tree planting. | Grade for the month. |
|--------------------------|--------------------|----------------------|--------------------------|----------------------|
| June.....                |                    |                      |                          |                      |
| July.....                |                    |                      |                          |                      |
| August.....              |                    |                      |                          |                      |
| September.....           |                    |                      |                          |                      |
| October.....             |                    |                      |                          |                      |
| November.....            |                    |                      |                          |                      |
| December.....            |                    |                      |                          |                      |
| January.....             |                    |                      |                          |                      |
| February.....            |                    |                      |                          |                      |
| March.....               |                    |                      |                          |                      |
| Grade for the year ..... |                    |                      |                          |                      |

.....  
*Teacher of gardening.*

A similar record should be kept for each pupil taking gardening.

The teacher's record book must contain complete information on each vegetable grown. The following form can easily be ruled on a page of a composition book and should be the easiest method of retaining this information.

*Specimen page—Teacher's plant record.*

Name of plant: Radish, Chinese White.

| Month.          | Number of<br>boys rais-<br>ing this<br>plant. | Area<br>planted in<br>square<br>meters. | Amount<br>of products<br>harvested. | Amount<br>of sales. | Amount<br>of seed<br>saved. |
|-----------------|-----------------------------------------------|-----------------------------------------|-------------------------------------|---------------------|-----------------------------|
| June .....      |                                               |                                         |                                     |                     |                             |
| July .....      |                                               |                                         |                                     |                     |                             |
| August .....    |                                               |                                         |                                     |                     |                             |
| September ..... |                                               |                                         |                                     |                     |                             |
| October .....   |                                               |                                         |                                     |                     |                             |
| November .....  |                                               |                                         |                                     |                     |                             |
| December .....  |                                               |                                         |                                     |                     |                             |
| January .....   |                                               |                                         |                                     |                     |                             |
| February .....  |                                               |                                         |                                     |                     |                             |
| March .....     |                                               |                                         |                                     |                     |                             |
| Total .....     |                                               |                                         |                                     |                     |                             |

*Teacher of gardening.*

A similar record should be kept for each plant grown in either the school or home gardens.

Among the valuable records a teacher should keep are the "Cultural notes." These should be made up at the end of the year and be an expression of the teacher's experience during the year.

*Specimen page for recording cultural notes.*

Name of plant: Radish, Chinese White.

*Soil.*—The radishes were planted in loose sandy soil which had been prepared to a depth of 30 centimeters. Four petroleum cans of carabao manure were mixed with the soil in the plot.

*Cultivation.*—Specially selected large seeds were planted and all plots kept clean. Water was applied in the evening of each day. At the end of thirty days the radishes were large enough to use. The radishes matured evenly and were of uniform size and quality. No heavy rains or storms were experienced.

*Plant enemies.*—The plants were free from enemies except that at one time a small bug attacked the leaves.

*Control.*—Dry powdered lime was sprinkled freely on the leaves. This was effective. No further damage was noticed, although it was necessary to apply the lime every third day for twelve days.

*Planting time.*—While radishes may be grown at any time, the best result is secured when the seeds are planted during the months of August and September.

Notes similar to these should be kept for each vegetable planted.

The supervising teacher should keep a record, to form a part of the permanent records of his office, covering:

1. Information required in the annual report to the Director of Education.

2. Information of permanent value or interest taken from the teachers' and pupils' notebooks.

3. A plan for the rotation of crops for the school garden, worked out for a number of years; a record should be made of vegetables raised in each plot.

4. A planting calendar giving the inclusive dates between which each of the vegetables raised in the locality may be planted. To be of service such records should be the averages of several years; they are of especial value to inexperienced teachers.

5. Information as to the amount and value of vegetables of every variety which may be raised on a standard plot. This information should show the amount and value of vegetables of one planting and for the year. Pupils should be expected, under normal conditions, to raise the amount decided upon as the average or standard.

6. Information as to the native vegetables grown in the local community, their uses, extent grown, local market value, and other data dealing directly with the food conditions of the community.

7. What new vegetables or fruits have been introduced and how they appealed to the people.



## Chapter VII.—HOME GARDENS.

### HOME GARDEN DEFINED.

A home garden, as previously defined, is a garden usually at the home of the pupil, but cultivated entirely by the pupil as a part of his school work under the teacher's supervision. A home garden should consist of not less than four plots of standard size carefully laid out and surrounded by a fence that will keep out all animals. Experience has shown that pupils take much more interest in their home garden than they take in their school plot and most of them will voluntarily plant more home plots than are required.

### GENERAL NEED.

The need of this feature of gardening work is obvious. There is hardly a Filipino family that could not have a good family garden if they would give it attention. Many are indifferent because they do not appreciate the value such a garden would have for them. The planting of home gardens by the pupils brings the matter to the attention of their parents and their neighbors, who often become interested and start separate gardens of their own by the side of the pupils' gardens. Comparatively few of the people realize how much food and how great a variety can be raised, until they have seen it demonstrated by their children. By means of the pupils' home gardens much good has been accomplished in the way of establishing permanent family gardens in the homes of the pupils; also in the homes of others who see their success.



A home gardener.

## SCOPE OF THE WORK.

The influence of a progressive teacher reaches many people besides his pupils and their parents. The home gardens are a constant advertisement of the school work. They attract attention from all passers-by as well as from the people of the neighborhood. For this reason it is best to have them in as conspicuous places as possible. The amount of good to be accomplished by home gardens scattered over a town or barrio is inestimable. In addition to furnishing a variety of fresh vegetables for the people they



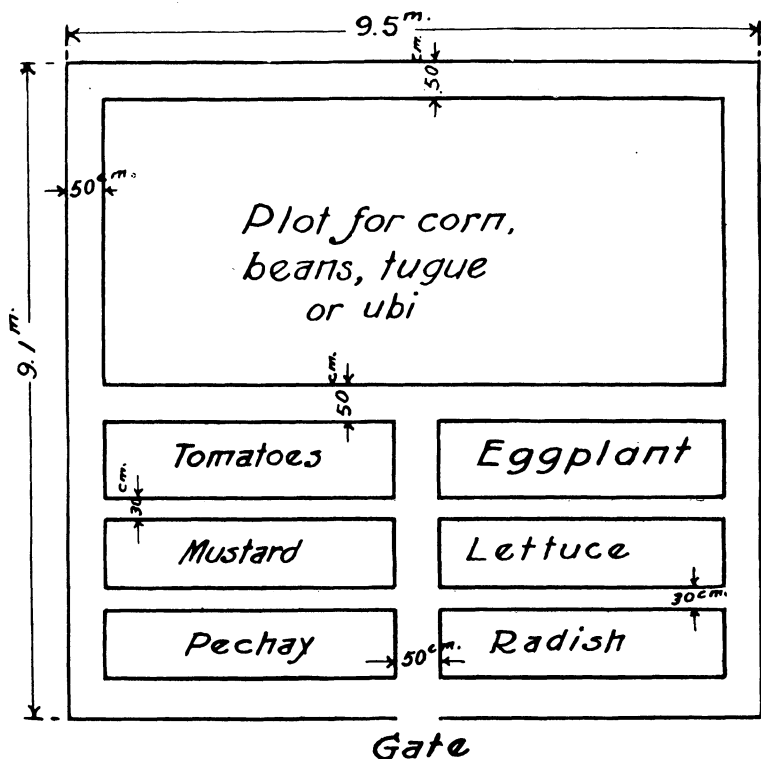
A communal home garden owned by five pupils, Tabaco, Albay.

encourage the planting of similar gardens. The teacher, in making his visits of inspection, gets acquainted with the parents and with their neighbors and is thus able to create a more sympathetic feeling toward the school work—gardening in particular—and to give helpful suggestions to people about caring for vegetables and farm crops. The teacher, working through his pupils, will have much influence toward bringing about cleaner yards and better kept homes. He should distribute decorative plants and tree seedlings and require them to be planted at the pupils' homes or along the street. A tactful teacher can even go so far as to make his pupils feel a certain responsibility

for the appearance of the premises around their homes, by offering helpful suggestions on each trip.

## TOOLS.

A large assortment of tools, although very convenient, is not absolutely necessary, as has been shown in many schools. Where modern tools are not at hand the boys can



Plan of a pupil's home garden. The small plots are standard size, 1 by 4 meters. Each gardening pupil is required to have a home garden.

dig the soil with a short iron bar, or if the soil is not too hard, a bamboo stick can be used. However, even in barrios, grubbing hoes can usually be borrowed by the pupils for the home work. But the teacher should make his pupils understand that they are not to be excused from having good gardens on account of not having modern tools to work with. A teacher should take pride in having gardens

made with local tools or tools made by the pupils. After the plots are made the only tool needed is a bamboo stick with which to loosen the soil of the plots and remove the weeds from the paths.

#### PLANNING THE WORK.

The first thing to do in starting home gardens is to talk the matter over with the class, placing a plan of a home garden on the blackboard for discussion and copying. The pupils should have their school plots finished before beginning the home garden in order that they may have a better idea of what they are to do at home. After the teacher has explained the home garden plan to the pupils they should be instructed to find a place to make their garden and to collect materials for the fence. Later the teacher should visit each home and make sure that the site is suitable before the boy puts up the fence; the site should be well drained and not shady. He should also approve the style of fence, assist the boys in laying out their plots, and see that the plots are dug 30 centimeters deep. He should attend to the planting of seeds in the germinating boxes at the school and should encourage the boys to have a germinating box at their homes. Boys who have not a suitable place for a garden at their homes may be allowed to make their gardens at some other place near the school. The vacant lots of the town might be used for this purpose.

#### SUPERVISION.

The pupils receive general instructions in the school garden, where they all meet with the teacher a little while each day. The teacher should visit each home garden one or more times a week. He should carry his record book with him and, in addition to taking notes, should grade each boy's garden. The pages for keeping a record of pupils' ratings should be ruled in such a way that there will be a place for a grade each week. There should also be a place for the grade of the school plot. At the end of the month these grades are averaged for the monthly grade in garden-

ing. Grading the plots each time makes the careless pupils more careful about their work.

The teacher should determine what his pupils are to plant in their plots and should help them to obtain the necessary seeds or plants. Teachers will find that it encourages the pupils to have them bring visitors to see the gardens. This also helps to arouse more interest on the part of the parents.

## Chapter VIII.—SCHOOL-GROUND IMPROVEMENTS.

### THE PLAN.

The Bureau of Education has adopted a plan looking to the permanent improvement of school grounds. The school grounds should be improved, from the sanitary and esthetic point of view, so that they may serve as models in this respect for the people of the entire community. A definite plan for the betterment of each permanent school site should be worked out. Bureau of Lands survey plans of school sites are furnished to the division superintendents; when



Building and grounds, Camiling, Tarlac.

this is received the site should be studied with a view of working out a permanent improvement plan. Improvements which are already made and which it is proposed to incorporate into the permanent scheme should be indicated on the plan in red ink. The suggested changes should be indicated in black ink. Improvements outlined below should be covered in the plan, if the site permits. All plans should be drawn to scale and all improvements accurately indicated.

1. The schoolhouse.

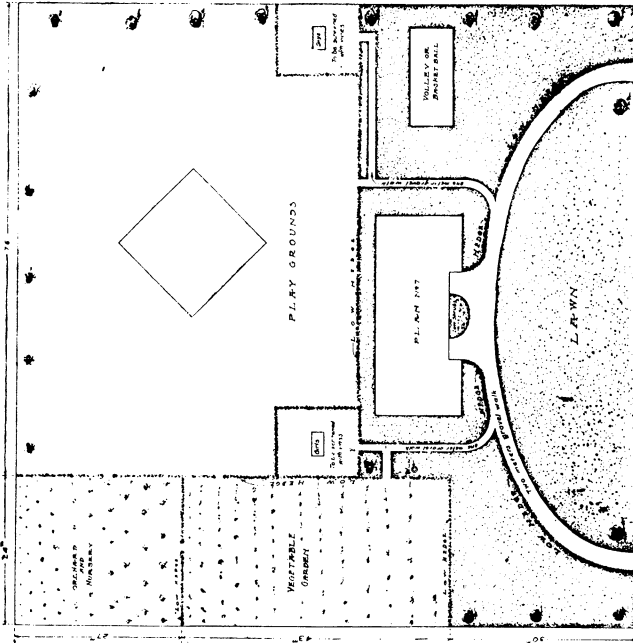
2. The fence, indicating the location of the gates.
3. The athletic field and playgrounds, showing the baseball field; volley ball, basket ball, and tennis courts; playground apparatus, such as swings, slides, etc.
4. Accessory buildings.
5. The well.
6. The garden, including the vegetable garden, nursery, and orchard.
7. Trees, shrubs, and lawn.
8. Any other improvements of a permanent nature.

When the plan has been carefully worked out to scale it should be approved by the division superintendent and forwarded to the Director of Education. The plan, with any changes made in the General Office, will be blue printed and copies will be sent to the division office for the division superintendent, the supervising teacher, and the municipal officials. Any later suggestions or recommendations for changes in the plan must be submitted to the Director of Education for approval.

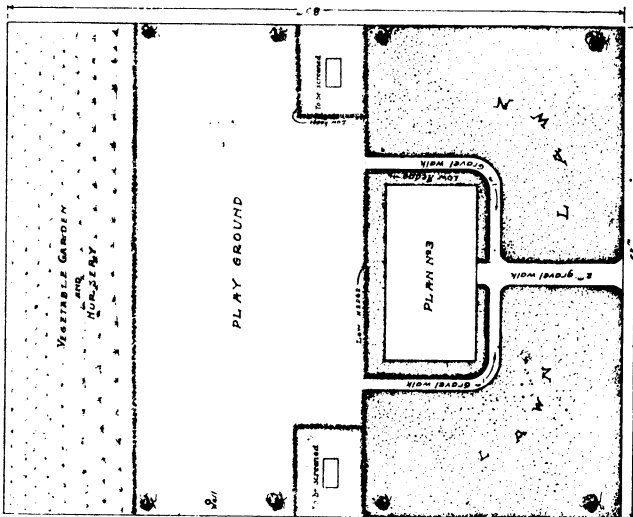
A statement should be submitted to the Director with the proposed plan showing:

1. The grading which may be necessary and the method proposed for having it done, including the estimated cost if it is proposed to have the work done at municipal or provincial expense.
2. The kind of fencing desired, the estimated cost, and whether or not it is planned to have the work done, in part or in whole, by the pupils.
3. The methods to be used and the plan to be followed in carrying to completion the entire improvement program.

Some of the work, such as the construction of lawns and walks, the planting of trees and shrubs, and the making of screens for outbuildings, can be done by the pupils; in some instances the construction of fences and outbuildings and the grading can be done, in part or in whole, by the pupils; work that is too difficult or heavy or which requires special skill or technical training, such as the construction of reinforced concrete outbuildings or fence posts, can often be done only by contract or administration. The proposed method of procedure should be indicated in each case in

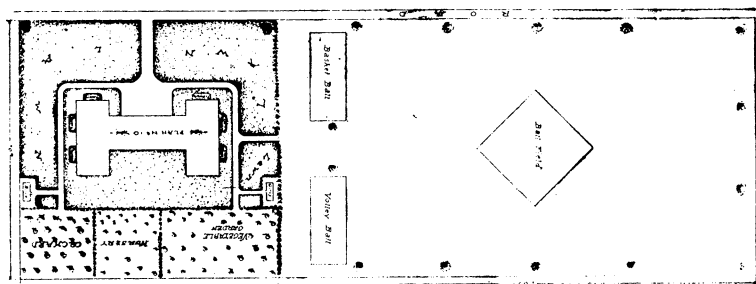


Showing two entrances to the grounds and a semicircular main walk.  
School grounds.

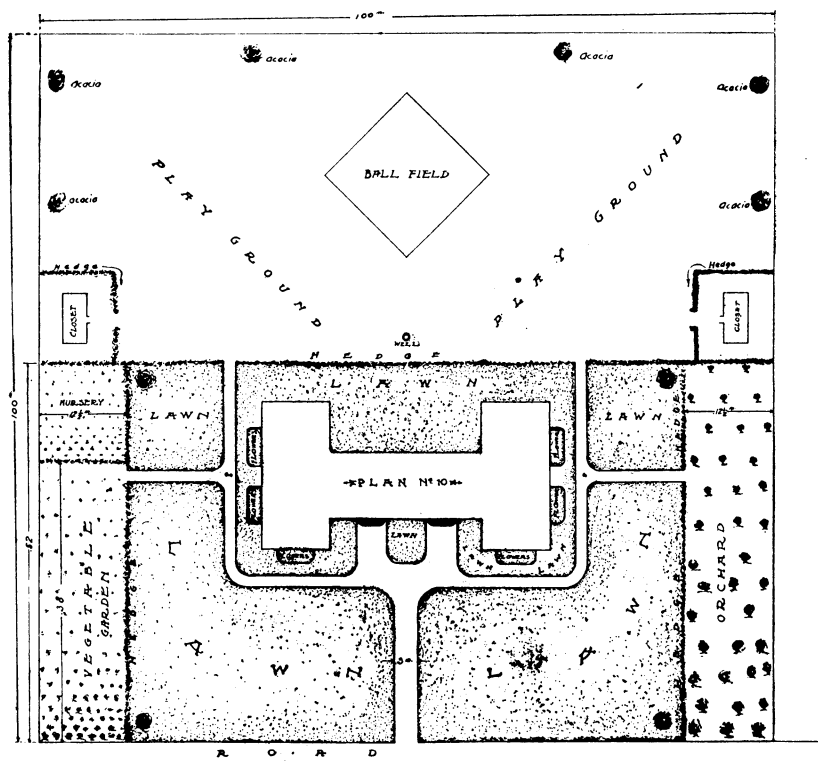


Suggesting how to locate a barrio school on a half-hectare site.





Suggesting how to locate a school building on a long narrow site.



Showing ordinary location of a building on a hectare site.

School grounds.

the statement which is submitted with the plan to the Director of Education.

At the beginning of the school year a definite plan of procedure for carrying out the improvements decided upon should be mapped out. The matter of securing an appropriation for fencing, grading, boring a well, constructing

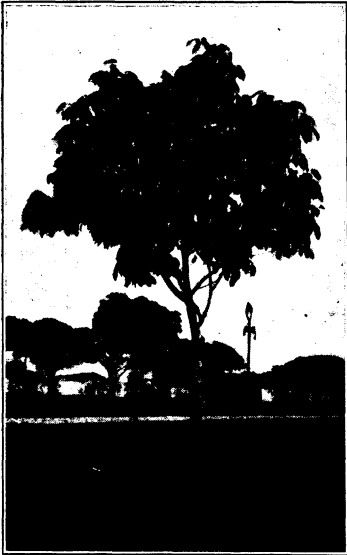


A gomamela bush.

outbuildings, or for any other project for which funds are needed should be taken up in the usual manner with the municipal council or with the provincial board, as the case may be, and as soon as funds are available the necessary requisitions for materials should be submitted and arrangements should be made for having the work done. Likewise

the work which is to be done by the pupils should be definitely outlined.

Suggestions and directions for the details of school-ground improvements will be found in Bulletin No. 37. A normal course in school-ground improvements should be given at every provincial normal institute and one teacher from each school in the division should be required to take this work, with the view of training at least one teacher in every



Taft trees on the old Luneta, Manila.



A young tree protected by substantial tree frame.

school to take charge of the improvement and care of school premises.

#### LOCATION OF THE BUILDING.

The location of the main building and its relation to the shop, domestic science, and other accessory buildings, is of prime importance. The location of these buildings should not be sacrificed for athletics, gardens or other school activities. If the site is not adequate additional land should be purchased contiguous to or as near as possible to the school site.

The present system of approving sites presupposes that the best available location has been secured. The main building should face the main road or principal street. It should be at right angles to the street. The distance that a building should be set back from the street depends largely on its size. The higher the building, or the greater the frontage, the farther it should be set back. In general this should be one or one and one-half times its frontage.

In front of the building there should be a lawn at least as wide as the building and sloping evenly away from the building and the central walk.



Standard revised building No. 2, properly located upon site.

The shop, domestic science, and other accessory buildings should be placed in such a manner as not to detract from the appearance of the main building. They must be within convenient reach of the main building; they should be placed a little behind it, or where the site is a corner, the municipal shop and domestic science building may face one street and the main building should face the other.

#### LAYING OUT THE GROUNDS.

When the plan has been made, steps should be taken to improve the grounds. Much may be done even before the building is erected. When the building has been completed,

every effort should be concentrated on the lawn, walks, drives, and plants immediately in front of the school. Then a sufficient number of pupils should be intrusted with its upkeep and the remainder assigned to the other school improvements in squads or classes. In laying out athletic courts and baseball fields, care must be taken that they are of standard dimensions.

#### THE FENCE.

The need of a fence is apparent to anyone conversant with Philippine conditions. This fence should be of the best type that can be constructed. Standard wire fences stretched on concrete posts fulfill this condition as they do not shut out the school grounds from the view of the public and they afford ample protection against destructive animals. Temporary fences deteriorate so rapidly that even where they are continually repaired they present a more or less shabby appearance.

#### WALKS.

Only such walks and drives as are necessary or of some artistic value should be made on a school site. They should go directly to the place toward which they lead, unless some characteristic of the site, such as a fine tree or knoll, acts as an obstruction. Unnecessary curves should be avoided. The gradient of the path should not be too steep, otherwise it is likely to be washed away with heavy rains.

Walks should vary in their width according to their importance. The walk leading from the entrance to the main building should be broader than those leading to accessory buildings; 3 meters will be wide enough for most schools. Other walks leading to the municipal shop, domestic science, and accessory buildings should be 1 meter in width. These should be surfaced with some substantial material such as gravel, broken shell, fine coral, crushed stone, or concrete.

#### HEDGES AND HEDGE PLANTS.

A hedge planted near schoolhouses constructed on the standard plans of the Bureau of Education will screen the open spaces which have been planned to admit ventilation under the building, and unless they are planted too near

the building they will in no way interfere with the purpose of the openings, but will set off the building to advantage and enhance the beauty of the simple architecture.

A hedge around a playground for girls may serve as a screen and give the desired privacy. A hedge around the vegetable garden, where the purpose is merely to separate



Violeta hedge correctly planted to set off a school building.

it from the rest of the grounds, will not detract from the general beauty of the grounds.

For a hedge up to 1 meter in height, the "violeta" is perhaps the best. This shrub produces flowers of beautifully variegated color all the year round, has luxuriant foliage, and does not suffer from severe pruning. For hedges 1 meter high or higher the hibiscus (gomamela), the "San Francisco," and the "buenavista" are especially adapted but require more careful pruning.

Where a high screen is desired, it can be made by training vines over a trellis made of ordinary chicken wire supported on a strong framework of tubular steel or hard wood.

#### THE WELL.

Wherever possible, a deep well should be drilled near the school premises so that a supply of pure water will always be on hand. Many deep wells give water containing in solution a greater or less quantity of mineral matter which may be injurious to plants. In such cases it will be necessary to dig a shallow well; the water from the deep well to be used only for drinking purposes and for bathing, and the shallow one fitted with a simple lift pump, for watering the garden, the lawn, and shrubbery. The time may come when in larger schools a force pump will be provided and a tank elevated from 3 to 6 meters above the ground. This will give water pressure for flush closets and shower baths as well as for the lawn and vegetable garden.

#### ORNAMENTAL PLANTS.

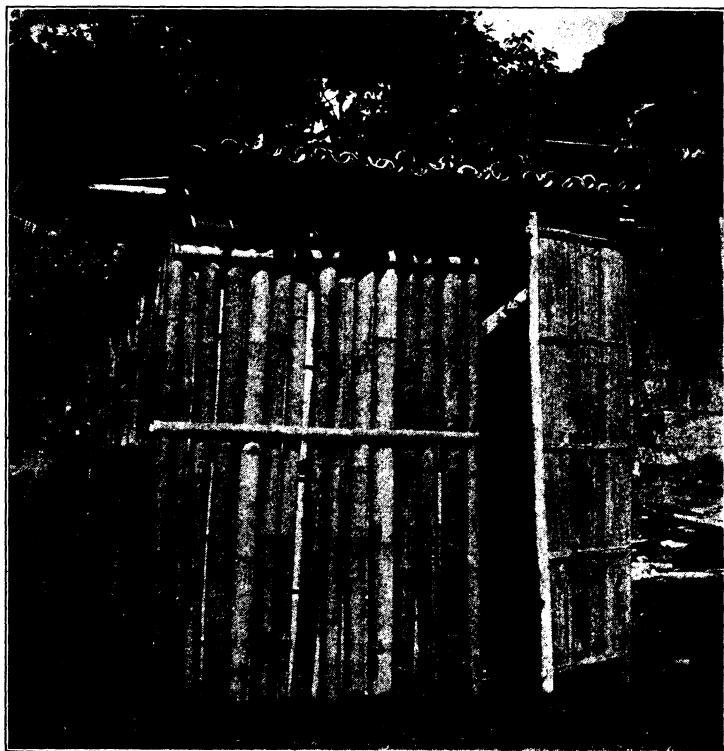
In the Philippines there is a common belief on the part of both Americans and Filipinos that in order to do ornamental gardening it is necessary to secure foreign plants. This is a serious mistake. In these Islands there are shrubs of all descriptions especially suited to this purpose. Vines abound which produce any color of flower desired and foliage especially pleasing. One can always secure from his own locality plants suitable for any phase of landscape gardening which may be desired. A study of the plants in the neighborhood should be first made. The various hedge plants mentioned above may be planted in clumps or even singly and are beautiful if they are well cared for and are kept trimmed.

#### THE PLAYGROUND.

The playground should be dry, level, and free from trees, shrubs, or other objects that would interfere with play. Shade trees may be planted on the border of the playground.



An example of effective screening.



Temporary bamboo closet.



Provision should be made for as many of the following games as is possible:

Baseball.

Basket ball.

Volley ball.

Indoor baseball.

Track and field athletics.

Tennis.

Care should be taken that all athletic fields and courts are regulation size. Adequate provision should be made for games for the girls and smaller pupils. A jumping pit and runway should be made and standards provided for the pole vault and high jump. There should be one or more horizontal or chinning bars and, wherever possible, swings should be made. Organized play should have a place in every school.

#### ACCESSORY BUILDINGS.

The accessory buildings should be plain and, where it is possible, they should be constructed of material similar to that of the main building. The surroundings of the domestic science cottage should be improved and maintained in such a way that they may serve as a model for the homes of the community. Temporary shop buildings can be constructed by the pupils at little expense. Extreme care should be taken that temporary buildings are neatly finished. The eaves of nipa or grass roofs should be evenly trimmed and the buildings should be screened with vines. Outhouses should be constructed on all school grounds. They should be partly or wholly screened by lattice work or wire fencing attached to wooden or tubular iron posts over which vines may be trained.

#### TREES.

The space available in the average school site will not permit the planting of a large number of trees. If they are planted along the edge of the school ground they will improve its general appearance. Trees planted near accessory buildings will help to screen them. The most satisfactory shade tree is the rain tree. It grows rapidly and gives shade throughout the year. Care should be taken that the

trees do not limit the space of the athletic field or garden. They should not be planted where they will shade the garden.

Trees peculiar to the locality should be grown wherever they serve the purpose.

#### CLEANLINESS.

Cleanliness is the first lesson to be learned in school improvement and is of prime necessity at all times. No matter how beautifully the school grounds have been planned and improved, unless they are kept clean they become unsightly and the teacher and pupils become proper subjects for adverse criticism.

#### CARE OF SCHOOL YARD.

The plan for improvements has already received mention. As each improvement is made steps should be taken to provide for its upkeep, and no new project should be undertaken until proper care of all the present improvements has been insured. Where this is done real progress is attained.

Probably the best way is the assignment of a teacher charged with the responsibility for the upkeep of the grounds, and the subdivision of the pupils into classes or groups, each charged with caring for a certain part of the grounds. Older pupils may be assigned to take charge of each group while at work. If the premises are looked after every day, the work will seem light and the pupils will be surprised at the results.

#### CARE DURING VACATION.

Provision should always be made for the care of the school premises during vacation. For provincial schools and central schools employing a janitor, the principal or supervising teacher should instruct one of the regular teachers, preferably one who expects to spend his vacation in the vicinity, to see to it that the janitor gives proper attention to the school grounds and buildings during the vacation period. It is advisable to adopt a plan for the rotation of this work so that it will not unduly burden any one teacher. For barrio schools and schools which do not

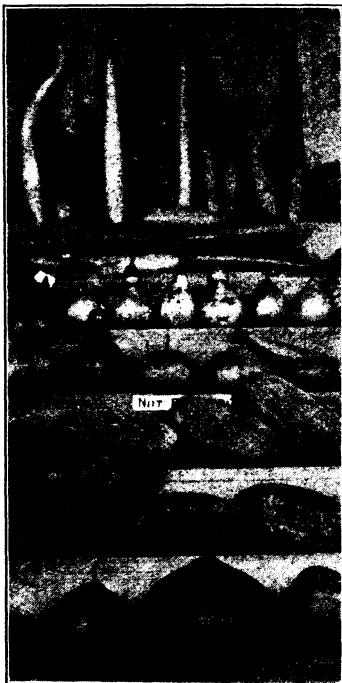
have the services of a janitor, a committee of pupils should be appointed by the teacher to have charge of the upkeep of the school premises during vacation. If the teacher remains in the barrio during vacation he should personally supervise the work of the committee of pupils; if not, he should appoint one of the older and more dependable pupils to take charge of the committee. Any other plan, approved by the supervising teacher and the division superintendent, which accomplishes the purpose, may be adopted, but in any case the responsibility for carrying out the plan for the care of school premises during the vacation period rests with the supervising teacher, or for a provincial school, with the principal.

Some time before schools close for the long vacation the supervising teacher should forward to the division superintendent a statement of the plans made for the vacation care of each school in his district.

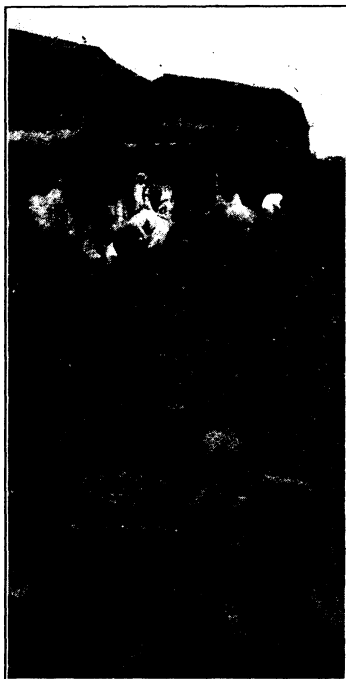
## Chapter IX.—GENERAL TOPICS.

### THE TEACHER'S HOME GARDEN.

Someone has said: "As the teacher is, so is the school." A teacher can show his interest in his garden work in no better way than by having a good garden at his home. A good example is sure to have a most beneficial effect upon the pupils.



Native edible gourds.



Cowpeas as an alternative crop.

Since the teacher's home garden will naturally be taken as a model, he must plan it with the utmost care. A good strong fence should be constructed and the soil fertilized and placed in perfect condition before any planting is done. Only such plants as will be fairly sure to succeed should be cultivated and the general appearance, methods employed, and results obtained should be such that the garden may be pointed out to the pupils as a model.

One important point to be kept in mind by the teacher when constructing his home garden is neatness. Whether in his vegetable garden or his flower garden, everything should be neatly and harmoniously arranged. The teacher's home should be kept in a sanitary and orderly condition, or the instructions given by the teacher in this connection will have little weight.

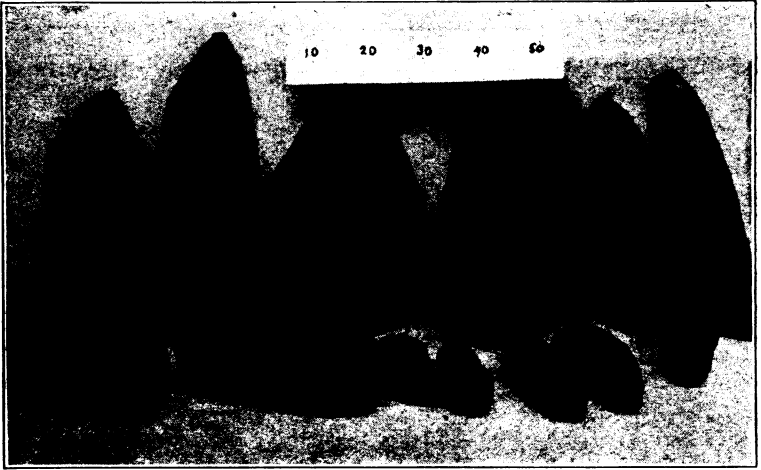
Not only should the teacher set the example for the growing of vegetables, but he should also be the leader in the growing of fruit and ornamental trees. There is usually a place at the home of every teacher where a few trees can be planted. He should be able to demonstrate proper methods of planting, pruning, and the building of guards for the protection of the trees. Where it is possible a small orchard should be planted with a few varieties of choice trees.

#### THE GARDEN DURING VACATION.

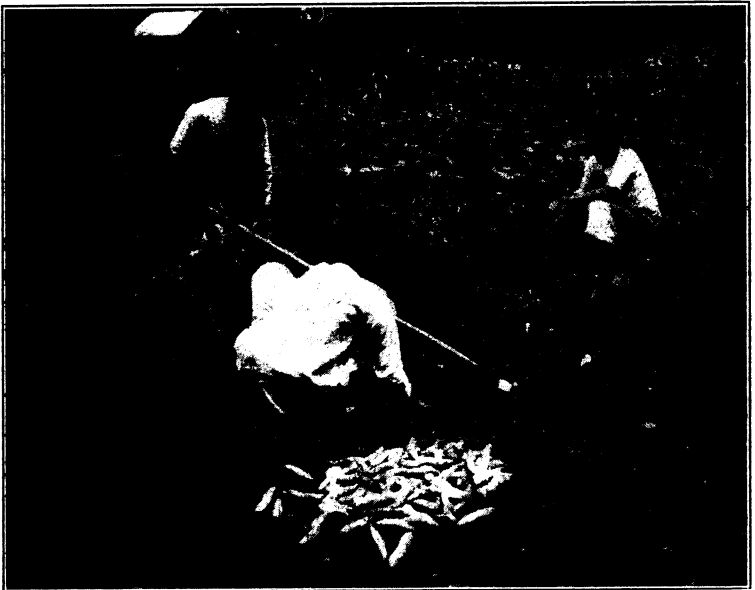
One mistake made by schoolboys is that of looking forward to their garden work's closing with the regular school work. The home garden work should be planned so that it may be carried on throughout the entire year. There are certain plants suited to each season. When school opens in June the teacher should make an outline of all plants which are to be grown during the rainy season and the dry season. The boy should know at the beginning of the school year what his vacation plants are going to be.

It is quite necessary that all plants which are to be grown in the home garden during vacation be well started before school closes; fences should be repaired, the soil worked into first-class shape, and definite arrangements made for proper care during the time when there is no school. A teacher should be assigned to oversee all vacation work, and boys should be made to understand that credit is given for this as well as for garden work done at any other time. A separate notebook should be kept for the vacation work, and this must be verified by the teacher in charge before credit is given.

The school garden should be planted to camotes, beans, or other crops which will cover the ground, some time before school closes for the long vacation. This will keep weeds



Some varieties of tugue—1913 agricultural exhibit of the Bureau of Education.



Primary school boys digging the camotes grown in the Malate Public School garden during vacation.

from growing in the garden, make it easier to work when school reopens, and enrich the soil. This vacation planting in the school garden should have a good start before school closes so that it will need but little attention during the vacation months.

#### GARDEN DAY.

Garden Day should have a permanent place on the program of every central school. It should be held when the garden products are in the most flourishing condition, and at a time when a large number of people may attend. Market day and fiesta day are good times, for the people come together more on those days than on any others.

In order to make Garden Day a real success, plans must be carefully worked out in advance. Booths should be constructed where choice vegetables may be exhibited, and where some of the most important steps of gardening may be demonstrated, such as seed testing, seed preserving, and methods of planting and transplanting. It would be well to have a separate booth where the preparation of vegetables for use may also be demonstrated.

Wherever possible the exhibition should be held near the garden, and boys should be assigned to explain all phases of the work both in the booth and in the field. Visitors should be encouraged to ask questions, and should receive the most courteous treatment in every way. Short literary and athletic programs can be given at this time, but they should be arranged so as to fit in properly with the other activities of the day. An active teacher should be in charge of each section of the day's program to see that the plans are carried out promptly and orderly. If prizes are given, care should be taken to secure impartial, competent judges.

#### CROP ROTATION.

Crop rotation as applied to gardening means the alternating or rotating of different garden crops on the same piece of land. There are several reasons why this is necessary. Different kinds of plants usually require different kinds of plant food; consequently, by rotating we are able to



Some Philippine vegetables.



Gomamela hedge.



get several good crops from a piece of land without exhausting the good elements of the soil. There is always more plant food in the soil than the plant needs, but the plant is often unable to use this, as the food is unprepared. By alternating the garden crops we are able to secure the breaking up of these elements, for each variety of plants uses a different method of preparing its food elements for use, and will therefore make a greater amount of plant food available in the soil than if only one kind of plant is grown.

In making out a plan of rotation for the garden it is very important that a boy should know the requirements of each of his garden plants, or he may rotate his crops in such a way that little good will come from it. For instance, beets and turnips should not follow each other, for they use practically the same kinds of plant food. But beets and lettuce have different requirements; consequently these can be advantageously alternated with each other. All of the garden plants should be carefully divided into sections, and under each section should be placed the plants which have the same plant-food requirements. The plan of rotation can be worked out from this outline with comparative ease.

The most valuable plants to be grown in the garden are legumes, such as beans and peas. These plants not only produce an excellent food, but also supply nitrogen to the soil. Nitrogen is required by plants more than any other single element. In making out the rotation plan, legumes should be included wherever possible and all parts of the garden should grow these plants at least once in two years. It is an excellent plan to grow legumes in the garden for a vacation crop, and then follow these with other plants during the school year. The following rotation plan has been successfully worked out:

| Rainy season.                     | Dry season.                                       |
|-----------------------------------|---------------------------------------------------|
| Beans and cowpeas.....            | Alternated with all kinds of leaf crops and corn. |
| Mustard, pechay, and lettuce..... | Alternated with beans or root crops.              |
| Radishes and camotes.....         | Alternated with beans, leaf crops, and corn.      |
| Corn with beans.....              | Alternated with garden fruits and vines.          |

## NATIVE YAMS.

There are several varieties of native yams which are more or less extensively used in all parts of the Philippines. They include cultivated and uncultivated varieties and are largely used in times of scarcity of rice or other staple food crops. Ubi, tugue, and camiguing or camangege are generally considered to be the most important; others not so highly esteemed are buga, carot, ballolong, limalima, and pannarien.

The ubi has heart-shaped, netted-veined leaves with red veins and midribs. The tubers often attain a large size, and weigh from 3 to 6 kilos; an old ubi plant may have as much as 20 kilos of tubers. They are irregular in form.

The leaves of the tugue are similar to those of the ubi. The tubers are cylindrical, from 15 to 20 centimeters long, and taper at the ends. Both tugue and ubi are propagated by planting pieces of the root.

The value of yams as a food should be emphasized and the methods of cultivating the plants and of preparing the roots for use should receive attention in the gardening and cooking classes.

## HOW TO PLANT A TREE.

The importance of properly planting a tree cannot be overemphasized. It is easy to set a tree in the ground in a haphazard way and still have it live, yet its growth will usually be slow and an undesirable tree will often be the result. If the planting is properly done the young tree will start off vigorously and its subsequent growth will be rapid and uniform.

Trees are usually propagated either from seeds or from cuttings. When the plants in the nursery have reached a height of from one-half to 1 meter, they may be transplanted to their permanent places. Several days before taking the plants from the nursery, dig the holes where they are to be set, not less than 65 centimeters in diameter and 50 centimeters deep, and then throw into the bottom a good supply of stable manure or surface soil containing a considerable amount of decayed vegetable matter.

When the holes have been prepared, dig the young trees from the nursery with a sharp spade or shovel. Care should be taken to secure as many of the roots as possible. When the plant is lifted out, all roots which have been bruised or broken should be carefully pruned off with a sharp knife. Do not permit any injured roots to remain on the plant, as they are likely to contract a disease which may subsequently injure the entire plant.

Carry the young tree to the place where it is to be planted without disturbing the soil around the roots more than is necessary. Place the tree in the hole and firmly pack decayed vegetable matter around the roots. When the hole is half full of soil, pour in about six liters of water and finish filling the hole. The soil should be slightly raised around the base of the tree and well firmed. A good mulch of grass or straw placed around the base of the plant will keep the soil moist and prevent excessive evaporation.

As soon as the tree has been planted it should have a strong guard built around it to protect it from animals. This guard may be made by driving into the ground three strong stakes about one-half meter from the base of the tree, and then tying to the stakes pieces of split bamboo. The stakes should be not less than 1 meter high, and the bamboo splits should extend to the top. The splits should be so firmly fastened that they will not come off.

#### HOW TO MAKE A LAWN.

No part of school-improvement work demands more planning and careful study than the making of a lawn. An exact map or plan of the proposed lawn should be made before the actual work of construction is begun. Remember that the lawn is to be a permanent part of the school premises, and should not be changed continually. Every tree, shrub, or walk placed in the lawn is supposed to remain there permanently.

The lawn should be level, or, if sloping, the slope should be uniform. See that the grade is established before beginning to plant. All holes should be filled in, all rough place smoothed down, and clods crushed into very fine parti-

cles. If the lawn is a large one it should be thoroughly rolled before any planting is done, but if small, a tamper made of a flat piece of wood with an upright handle will serve the purpose. A long plank with a straight edge may be used in establishing a uniform grade. The soil in the lawn should be made very rich at the outset, for this is practically the only fertilizing it will receive. Forest mold, compost, and stable manure make the best fertilizers, and if the lawn is small can be supplied in sufficient quantities by most schools. Good drainage is essential.



Lawn with trees along the border.

When the soil has been prepared Bermuda grass, cut into 15-centimeter lengths, should be planted from 2 to 4 centimeters apart in rows 10 centimeters apart. The plants should be watered every evening for four or five days and frequently thereafter until the grass has a good start. The lawn should be rolled two or three times during the first three weeks.

It is essential that a lawn mower be procured and that the lawn be cut as often as needed. A lawn poorly kept presents an unsightly appearance. Grass shears, to keep the edges of the lawn evenly trimmed, will be needed in some cases.

## IMPROVING HOME SURROUNDINGS.

The improvement of home surroundings has been taken up in several places in this bulletin in connection with home gardening. For the pupil and the community the great value of the improvement of the school premises is that it affords an example and a practical working plan for general home and town improvement. Through the improvement of the school grounds the pupils receive practical instruction in sanitation, the making of lawns and walks, the grading of grounds, and the planting of trees, shrubs, and hedges. The extension of this work to the home of the pupil should be undertaken in conjunction with the garden work. The proper location of suitable outhouses should be considered in this connection. The teacher should first consult with the pupil's parents or guardian and receive the assurance of their approval and coöperation before assigning him to any task in improving his home surroundings. Appropriate home work for the pupils, under the guidance and supervision of the teacher, would be:

To grade the grounds, filling all low places so as to prevent water from collecting under or near the house.

To construct drainage ditches.

To make lawns.

To plant ornamental, fruit, and shade trees, and shrubs.

To repair fences.

To clean up the street in front of the house.

To make provision for the disposal of kitchen refuse.

To make walks of gravel, or other satisfactory materials, where they are needed.

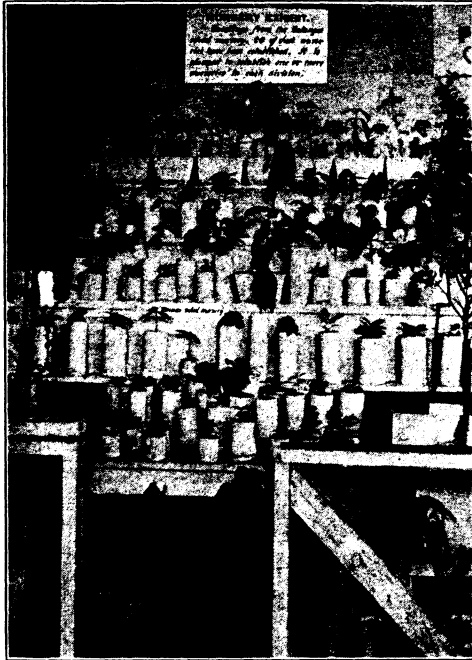
## SCHOOL NURSERIES.

A nursery, where fruit, shade, and ornamental trees and shrubs and other plants may be propagated for use on the school grounds or for distribution, should be established in connection with every central school garden. At least six plots should be set aside for this purpose. The plots should be prepared and fertilized as for the garden vegetables.

One plot may be planted with seeds of the rain tree, as this is the most suitable for general planting for shade purposes. Fruit trees such as oranges, limes, santols,

duhat, and others which are grown in the locality, should be propagated in the nursery. Gomamela and similar shrubs should be grown for hedges or for planting singly. Violeta cuttings may be started in a sand box or by planting the cuttings in the ground. It is usually preferable to start the violeta plants in this manner before planting them in their permanent places in a hedge.

Small plants may be grown in bamboo tubes or in ordi-



Nursery exhibit at the 1912 agricultural exhibit of the Bureau of Eduoation.

nary tin cans. A half-inch hole should be made in the bottom of the can for drainage. Another method is to melt the joints and tie the body of the can together with wire or rattan. When the time comes for transplanting into the open ground the wire or rattan is untied and all of the soil is easily removed with the plant. Bamboo pots, split and tied together, serve the same purpose.

Trees and plants should be grown for planting at the

homes of the pupils. All boys might be encouraged to plant and care for a certain number of fruit trees at their homes. The sale of seedlings grown in the school nurseries may be extensively carried on. There is a need in every town for a nursery where the best locally grown plants may be distributed. An exchange system, whereby plants common in one part of a province may be exchanged for those grown in another section, is encouraged.

#### THE TOWN MARKET.

Teachers and pupils should familiarize themselves with the local market. They should visit the market frequently to find out what vegetables and fruits are offered for sale, their prices, and where they were raised—whether they were grown in the immediate vicinity or were brought in from a distance. They should make lists of the vegetables for sale and ascertain which ones are the most popular.

The manner of exhibiting vegetables should be noted, how they are prepared and put up for sale, and whether or not they are exhibited under sanitary conditions. The market should be maintained in a sanitary and orderly condition; if not, ascertain what provision has been made for the inspection of the market and for enforcing municipal ordinances relative to the care and upkeep of the market and its surroundings.

It is desirable to impress upon the pupils that they could raise at their homes many of the vegetables which they are in the habit of buying in the market. The home-grown produce would always be fresh and it would be available at all times.

#### COURSES IN GARDENING FOR NORMAL INSTITUTES.

Along with the standardization of the garden work comes the necessity of providing means whereby the teacher may become acquainted with the desired standard and plans for this line of industrial work. Definite instructions must be given in order that teachers may be able to see the pedagogical principles underlying industrial instruction. It is necessary that the teacher know the difference between manual labor and manual training as



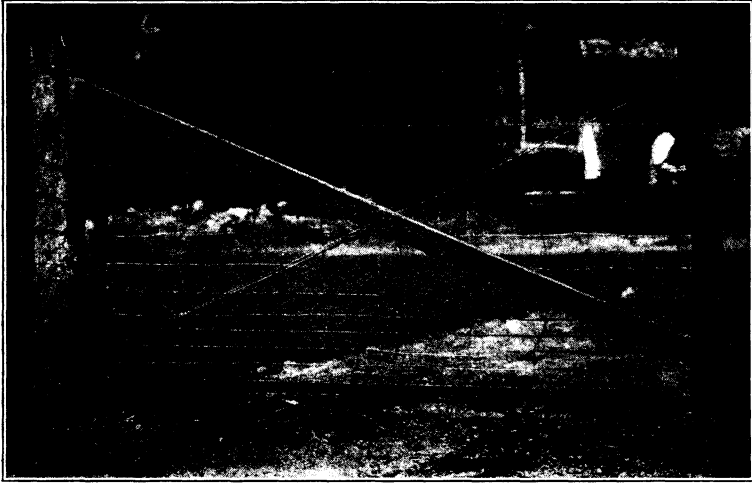
Field work in gardening at Occidental Negros 1911 normal institute.

applied to the industrial activities of the schools. Since there is a required standard in gardening, it is advisable to adopt a series of suggestive normal school lessons in order that teachers attending provincial and Insular normal institutes may become acquainted with the proper methods of organizing and conducting garden classes in their respective schools. After the teacher has completed a four weeks' course in this work he should be able to return to his school and organize the garden classes, applying pedagogical principles similar to those upon which the academic instruction is based.



Primary pupils fencing a school garden.





Corner post braced and strengthened.

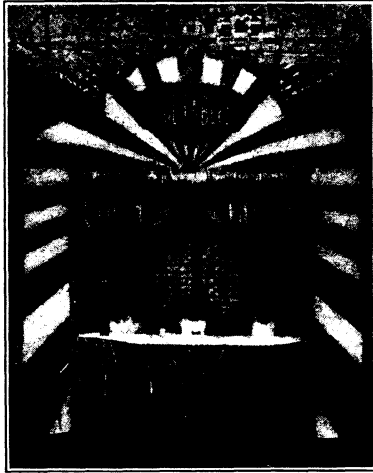
Teachers give much of their time and go to considerable expense to attend a normal institute and the work must be organized so that they will get definite returns in the way of actual instructions for carrying out the desired work in their schools.

Four graded courses to be given at normal institutes are here suggested:

1. Course for teachers of gardening in primary schools.



Class in fencing doing practice construction work—1912 Vacation Assembly, Manila.



One of the booths at the Malabon, Rizal, Corn Demonstration, 1912.

2. Course for teachers of gardening in intermediate schools.
3. Advanced lessons in gardening.
4. School-ground improvements.



Final corn exhibit of the 1912 Corn Campaign of the Bureau of Education.

By the use of such a series of standard normal courses means are provided whereby a teacher may specialize in gardening and may continue his studies through several normal institutes. An extended course of this nature is possible only when all teachers are required to begin their normal work with the lower course and to continue through to the most advanced course.

#### FOOD CAMPAIGNS.

In all agricultural communities it has been the custom to give special emphasis to certain features of the work in order to develop any crop or to introduce a desirable plant. During the past ten or fifteen years this plan has been quite successfully followed in the different sections of the United States. Its main purpose is to interest the general public and in this manner to increase the production and use of some specific plants. It is conceded that the general public is very quickly interested and that definite results are secured. In the United States special clubs have been organized for conducting the campaigns. Corn and tomato clubs are more numerous than any others, although sometimes contests in cooking, canning, and flower culture are featured.

This idea has entered the Philippines as a campaign to promote the growth and use of corn as a human food. The campaign begun in 1912 has been continued as the 1913 Corn Campaign and includes legumes as a crop to be grown as a food in connection with corn. Various types of demonstrations are planned.

Such food campaigns will continue and the success obtained in any school will depend upon the teacher. As soon as the campaign is authorized the teacher should know the part his school is expected to play.

## Chapter X.—CLASSROOM LESSONS.

Plans should be made to give the classroom instruction, to make the garden plans, and to perform such experiments and demonstrations as are necessary, on rainy days when it is impossible for the pupils to work in their gardens. Consideration should be given to the fact that the gardening pupils may be drawn from different academic grades and the work should be planned accordingly. A regular plan or outline of lessons should be made by the supervising teacher to suit the needs of the schools under his supervision. Suggestions for this work follow:

1. Drawing:

- (a) A plan of the school garden.
- (b) A plan of the pupil's home garden.
- (c) Planting plans.

The plan of the home garden and the planting plans should be drawn in the pupil's notebook.

2. Instructions and directions given by the teacher should be written on the blackboard and copied in the pupil's notebook. They should include:

- (a) Cultural directions.
- (b) Planting tables.
- (c) The planting calendar as worked out for the division or locality.
- (d) A crop rotation plan for the pupil's home garden.
- (e) Diaries and records.
- (f) Recipes for preparing vegetables for use.
- (g) Other instructions and directions, which should be brief and simple, which the teacher believes should be preserved by the pupils.

3. Pupils may be requested, as a class exercise, to write an order for seeds, a request for a seed or tool catalogue, or for prices of tools; the best one submitted should be corrected by the teacher, rewritten, and with the approval of the supervising teacher, mailed. Letters received from business firms in response to inquiries and orders may be used as models.

4. Composition writing on topics that are suggested by the pupil's work. Suitable topics would be: A Corn Demonstration; How to Grow Tomatoes; Why I Intend to be a Farmer; Varieties of Native Yams and Their Uses.

5. Government bulletins, periodicals, and seed and tool catalogues furnish subject matter for instruction to be given in the classroom or garden. Prices of tools and seeds, and pictures of vegetables, fruits, growing plants, gardens, lawns and grounds, found in catalogues are interesting and valuable.

6. *Garden arithmetic*.—A large variety of problems will be suggested by the garden work. Suggestive problems follow:

(a) Find the dimensions of the school garden. How many square meters does it contain? Find the area of one plot; the total area of all the plots in the garden; the area of the paths.



Boys learning to cook vegetables.

(b) Adapt the above problem to the pupil's home gardens.

(c) Ascertain the value of one crop of pechay raised on a standard plot. How many crops may be harvested in a year? Find the value of the pechay which could be raised on one-tenth of a hectare in a year, based upon the amount actually produced on a standard plot.

(d) Apply the foregoing to other vegetables raised in the school and home gardens.

(e) Ascertain the cost of garden tools such as hoes, rakes, spades, shovels, and spading forks. How many plots of pechay, tomatoes, or other vegetables will a pupil need to have in his home garden in order to raise and sell enough produce to secure the tools he may

need? (In this connection older pupils, who can do so, should be encouraged to do a certain amount of market gardening and to earn enough to purchase the tools they need. The first consideration, however, is to raise vegetables for home use.)

(f) Ascertain the number of kilos of camotes that may be produced on 100 square meters. What will be their value at current prices in the local town market?

(g) Make an inventory of the tools used in the school garden. Ascertain their total cost.

(h) Make model orders for seeds for the school and home gardens and find the total cost of the seeds.

(i) Prepare a bill of materials for a fence for the school site and ascertain the cost.

(j) Estimate the cost of a seed house for the school garden; the cost of the seed boxes.

(k) Give the names and uses of the different garden tools.

7. *Laboratory work*.—Exercise 1: To test the germinating power of seeds. Count out from 5 to 20 seeds of the kind to be tested and place them in a plate between two folds of a moist cloth or pieces of thin blotting paper. On a slip of paper record the variety, number of seeds, and the date, and place it on the edge of the plate. Cover the whole with another plate to prevent too rapid evaporation. It may be necessary to sprinkle the seeds occasionally with water. Examine the seeds every morning and afternoon for six or eight days or until all good seeds have sprouted. Count the sprouted seeds and determine what percentage of the whole number of seeds is fertile. Eggplant, onion, pepper, and other hard-coated seeds which have been stored for a considerable period of time may not germinate readily. Such seeds will germinate more quickly if soaked in warm water for one hour.

Exercise 2: To test the germinating power and vitality of corn.

Make a low box or tray 4 centimeters high and about 35 centimeters by 60 centimeters and divide it with strings into 5-centimeter squares. The tray may be filled with moist sand.

Remove five kernels from each ear of corn to be tested, as follows: (a) One about 5 centimeters from the butt of the ear; (b) one about 5 centimeters from the tip of the ear; (c) three from points between the kernels already chosen. No two kernels should be from the same row. Each of the first four kernels is set, point downward, in one corner of a square, and pushed down far enough to be covered by the sand. The fifth kernel is planted in the center of the square. Each ear should be marked with the number of the square in which its seed has been planted. The seed must be kept moist. When the plants are 5 or 6 centimeters high examine them carefully. If a square has five strong, healthy plants, the ear with the corresponding number should be kept for seed. Reject every ear from which the seed has failed to germinate or which has produced weak or sickly plants.

Exercise 3: To show that large, heavy seeds, containing more plant food, produce more vigorous plants.

Take a tray similar to that used in exercise No. 2. Bake the sand to kill the mold, if the sand has been used once. Plant some large radish, corn, or pechay seeds or beans in a few squares, and light, poor seeds in other squares. Note the difference in color, size, and strength of plants.

Exercise 4: To show that water rises in a plant.

Fill a glass half full of water colored with a few drops of red ink. Place in the glass freshly cut stems of pechay, other plants, or cut flowers. In a short time the water will rise through the stems and may be seen in the red veinlike patterns in the petals or leaves.

Exercise 5: To determine the proper depth to plant seeds.

Seeds which are small and fine must not be deeply covered with earth; if they are, the weak germs which they contain will not be strong enough to reach the light and air. Large seeds which contain a large amount of plant food, such as peas, beans, and corn, may be planted more deeply. The development of young plants from seeds may be nicely observed by planting seeds against the sides in tall bottles or glass jars or in a box with glass sides. Beginning at a distance of 11 centimeters from the top of the jar or box, place a kernel of corn; on top of this place a layer of earth, and continue at intervals of 2 centimeters until a series of seeds rest against the glass from 11 centimeters below to within 1 centimeter of the surface. Try various other seeds in like manner.

The glass covering the seeds should, except in time of observation, be kept covered with light-proof material to keep the growing seeds constantly in the dark.

Exercise 6: To show that plants need light.

Plant two or three kernels of corn in each of two bamboo pots. Place one in a lighted place where it will receive a normal growth. Place the other under a box or where light cannot penetrate. Give both the same attention as to watering; note the difference between the two sets of plants. After the plants grown in the dark have attained a height of 4 or 5 cm. remove the covering and note what takes place when the pot is placed in the light.

Call to the attention of the pupils that plants growing in a poorly lighted room reach out toward the nearest window. Notice the tendency of the forest trees to send their branches up to the light.

Exercise 7: To show that plants need moisture.

Take two bamboo pots in which plants are growing. Put them under like conditions but withhold water from one for several days, and note results.

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